

JAN 2 1942

AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

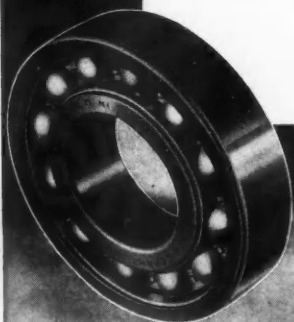
JANUARY 1, 1942

New Departure .. all out for defense

Concentrating its great manufacturing facilities on the production of ball bearings to established American standard metric dimensions and tolerances, for quickest possible deliveries.

“ “

A special bearing requires extra tooling and different machine set-ups—might well delay delivery of many standard bearings. Government and industry are cooperating in speeding defense with *standard* bearings. New Departure, Division of General Motors, Bristol, Connecticut.



New Departure
THE FORGED STEEL BEARING

NEW TOOLS... NEW STEELS... NEW MEN?

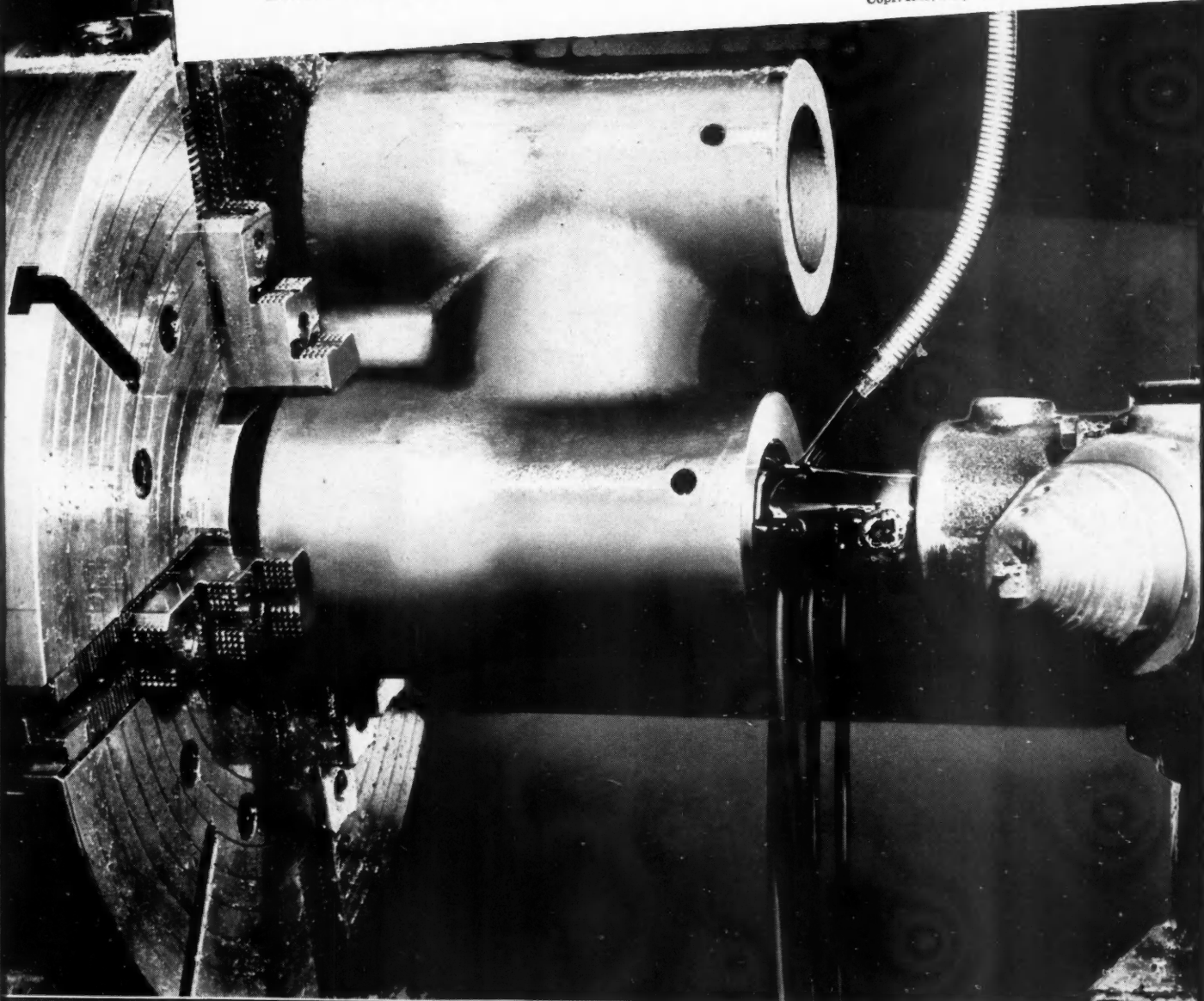
NEW CUTTING OILS MAY HELP OVERCOME THESE HANDICAPS

- How can you get longer life from the tools that are available? How can you produce a fine finish on the new steels? How can you be sure of accuracy and high production with new operators? Are these some of the questions that haunt you today? The answers may be found in the cutting oils

you use. And a Standard Oil Engineer can help you find them. He understands these problems. He has been working on them with other manufacturers and with the Technical men of Standard Oil. New products have been made available where needed and new recommendations set up to meet present day production requirements.

Why *experiment* with cutting oil and coolant mixtures? Take advantage of the work that has been done for you by calling in a Standard Oil Engineer. Just write the Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois. Ask for the Engineer nearest you.

Copr. 1942, Standard Oil Company (Indiana)



STANDARD OIL COMPANY (INDIANA)

AUTOMOTIVE INDUSTRIES

AUTOMOBILE

Reg. U. S. Pat. Off.
Published Semi-Monthly

Volume 86

Number 1

JULIAN CHASE, Directing Editor
P. M. HELDT, Engineering Editor JOS. GESCHELIN, Detroit Technical Editor
J. R. CUSTER, Ass't Editor JEROME H. FARRIS, Ass't Editor
E. L. WARNER, JR., Detroit News Editor L. W. MOFFETT, Washington News Editor
MARCUS AINSWORTH, Statistician J. DONALD BROWNE, Washington News Editor
HOWARD KOHLBRENNER, Art Editor

CONTENTS

For These Things We Now Fight. By K. T. Keller	17
McCulloch Superchargers in the Making. By Joseph Geschelin	18
Brazing Carbide Tips on Tools	25
Use of the Oscillograph for Testing Fuel Injection. By P. H. Schweitzer	26
Automatic Welding Aids Clutch Production	30
What the Industry is Doing	31
West Coast Airplane Plants. By Joseph Geschelin	32
Men and Machines	40
Production of Primary Trainers at Ryan	42
Production Lines	44
News of the Industry	45
Calendar of Coming Events	60
Advertisers' Index	94

Copyright 1942 by Chilton Company (Inc.)

Automotive Division
Jos. S. HILDRETH, President and Manager
JULIAN CHASE, Vice Pres. G. C. BUZBY, Vice Pres.

OFFICES

Philadelphia—Chestnut & 56th Sts., Phone Sherwood 1424
New York—100 East 42nd St., Phone Murray Hill 5-8600. Chicago—Room 916 London Guarantee & Accident Bldg., Phone Franklin 4243. Detroit—1015 Stephenson Bldg., Phone Madison 2090. Cleveland—609 Guardian Bldg., Phone Cherry 4188. Washington—1081 National Press Bldg., Phone District 6577. San Francisco—444 Market St., Room 305, Phone Douglas 0967. Los Angeles—6000 Miramonte Blvd., Phone Lafayette 5525.
Cable Address.....Autoland, Philadelphia

Member of the Audit Bureau of Circulations
Member Associated Business Papers, Inc.

Automotive Industries—The Automobile is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903, the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by
CHILTON COMPANY
(Incorporated)

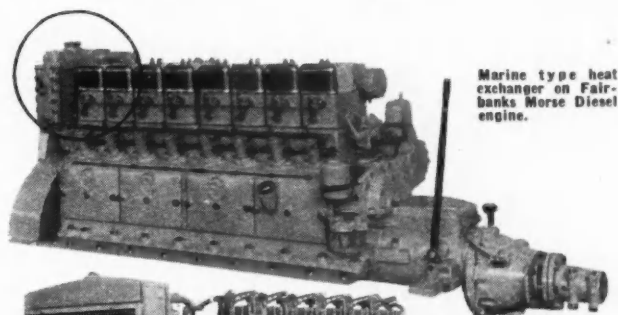


Executive Offices
Chestnut and 56th Streets, Philadelphia, Pa., U. S. A.

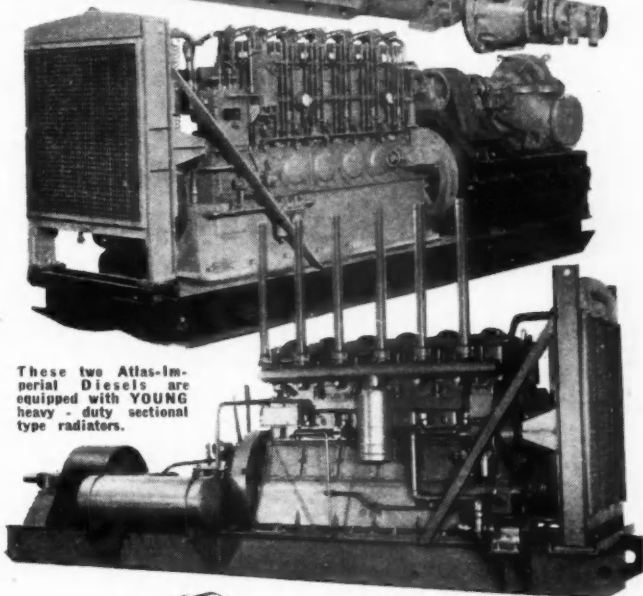
Officers and Directors
C. A. MUSSELMAN, President

Vice-Presidents

JOS. S. HILDRETH GEORGE H. GRIFFITHS
EVERIT B. TERHUNE J. H. VAN DEVENTER C. S. BAUR
WILLIAM A. BARBER, Treasurer JOHN BLAIR MOFFETT, Secretary
JULIAN CHASE THOMAS L. KANE G. C. BUZBY
P. M. FAHRENDORF HARRY V. DUFFY CHARLES J. HEALE



Marine type heat exchanger on Fairbanks Morse Diesel engine.



These two Atlas-Imperial Diesels are equipped with YOUNG heavy-duty sectional type radiators.



MORE BIG DIESELS

COOLED BY YOUNG

More and more big name manufacturers of Diesel, gas and gasoline engines are turning to YOUNG for the practical solution to their cooling problems. Responsible for this trend is the ability of YOUNG-engineered units to meet the most exacting requirements of modern internal combustion engines. Whatever the installation, YOUNG can furnish a radiator or heat exchanger to fit your requirements. YOUNG engineers are thoroughly familiar with every phase of heat transfer. They take pride in tackling the toughest cooling problems. Why not consult them about yours?

YOUNG RADIATOR COMPANY

Racine, Wisconsin Dept. 212-A U. S. A.

DISTRIBUTORS

The Happy Co., Tulsa, Okla. H. R. Flournoy, Bell, Calif.

Young

High Efficiency

HEAT TRANSFER PRODUCTS

MANUFACTURERS OF

UNIT HEATERS • CONVECTORS
• CONDENSERS • EVAPORATORS
AIR CONDITIONING UNITS
HEATING COILS • COOLING COILS

OIL COOLERS • GAS, GASOLINE
DIESEL ENGINE COOLING RADIATORS
• INTERCOOLERS • HEAT EXCHANGERS
• ENGINE JACKET WATER COOLERS

January 1, 1942

When writing to advertisers please mention Automotive Industries

3

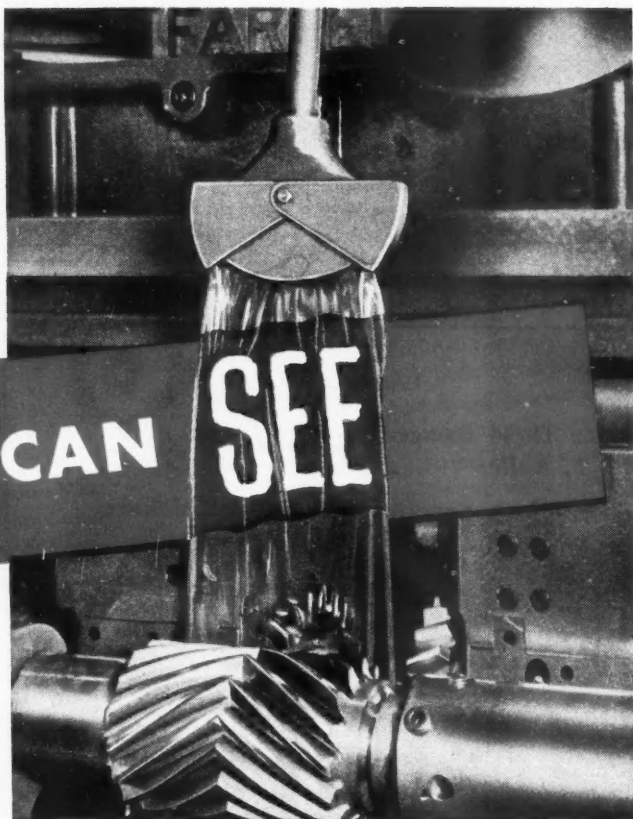
AUTOMOTIVE INDUSTRIES, Vol. 86, No. 1. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In Case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, \$1.00 per year. Canadian and Foreign \$2.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 1, 1942), 50 cents.

GREATER OUTPUT...

BECAUSE YOU CAN

SEE

TEXACO TRANSULTEX in use by Lufkin Foundry & Machine Company, Lufkin, Texas, on herringbone pinion job. Big success here for past 3 years.



MORE PIECES per hour can be made, when you use a cutting oil that lets you *see* to adjust cutter and work *without stopping the machine*. Such an oil is *Texaco Transultex Cutting Oil*.

On tough jobs, high carbon, nickel, chromium and stainless steels, cutters stand up longer, finish is smoother, output is up. *Texaco Transultex* is so transparent that you can read newsprint through an inch of it.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred also in the metal cutting field.

These Texaco users enjoy many benefits that can also be yours. A Texaco Engineer specializing in cutting coolants will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distribution points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

- ★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.
- ★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.
- ★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.
- ★ More stationary Diesel horsepower in the U.S. is lubricated with Texaco than with any other brand.
- ★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.



FOR YOUR ENJOYMENT—TWO GREAT RADIO PROGRAMS
FRED ALLEN every Wednesday night. See your local newspaper for time and station.

METROPOLITAN OPERA. Complete broadcasts of great operas every Saturday. See your local newspaper for time and station.



TEXACO Cutting and Soluble Oils

FOR THE METAL-WORKING INDUSTRY

RETURN METAL DRUMS PROMPTLY . . . thus helping to make present supply meet industry's needs and releasing metal for National Defense.

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Volume 86 January 1, 1942 Number 1

Bureau of Standards Tests Alloy Cast Iron

Tests recently concluded at the National Bureau of Standards have developed much needed data on the elastic properties of three types of alloy cast iron, according to the department of Commerce. This information is particularly important under present emergency conditions when, because of the difficulty in obtaining steel shapes, cast iron is being used to a rapidly increasing extent for many structural parts, in addition to such familiar applications as piston rings, cylinder liners and similar products. The tests, conducted by Col. A. I. Krynsky and C. M. Saeger, Jr., were made in the Bureau's experimental foundry under conditions approximating commercial practice.

Transverse strength, deflection, resilience, and hardness measurements were made on test bars from iron which had been melted in a high-frequency induction furnace. Before pouring, the metals were heated to various temperatures above the point at which the iron liquefied. Maximum heating was shown to be of greater benefit in the case of plain carbon irons than alloy irons, while the effect of pouring temperature on plain carbon and alloy irons was about the same, both kinds showing a tendency to become weaker and less elastic as the temperature was raised.



January 1, 1942

McCulloch Superchargers in the Making

18

In this, the sixty-sixth monthly production story, the author takes us for a trip through the plant of the McCulloch Engineering Co. Keyed up to war-time program this organization has accomplished some outstanding feats on the production line. Be sure that you read about them.

Brazing Carbide Tips on Tools

25

This is a comparatively new technique and has presented some difficulties at times. How it is being done successfully in the regular line of work is the subject of this article. It will pay dividends for the time it takes to read it.

Use of the Oscillograph for Testing Fuel Injection

26

Complete with text and illustrations this article thoroughly covers the subject. The author says that the cathode-ray oscillograph gives the quickest and most informative results. From that he goes on to prove his statement.

West Coast Airplane Plants

32

This is the second of a series that bring to the front the great change that has taken place in the production methods in what is now the country's most potent industry.

Production of Primary Trainers at Ryan

42

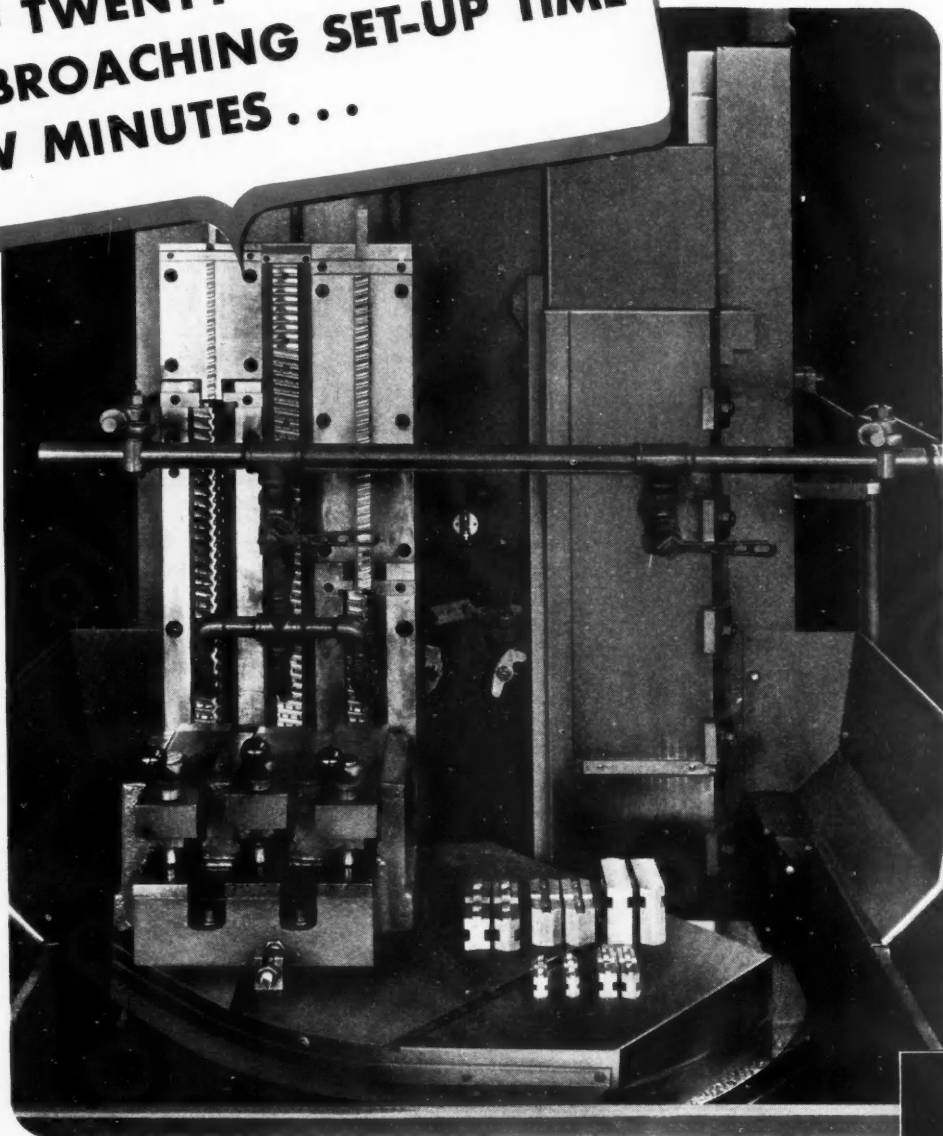
This is a picture presentation of the production methods of the PT-22 trainer planes at the Ryan plant. Generous captions augment the pictures.

News of the Industry

45

Events are coming fast in these days. Neglect of the News Section of this issue is sure to leave you in ignorance of happenings that you should be informed on.

**FAMILY OF TWENTY
REDUCES BROACHING SET-UP TIME
TO A FEW MINUTES . . .**

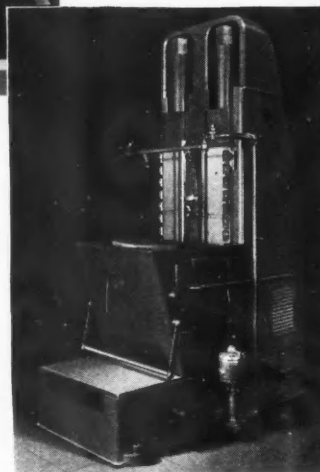


ONE of the chief difficulties in using the rapid broaching process for machining a variety of short runs is the relatively large amount of set-up time ordinarily required to change from one part to another. This objection can readily be eliminated if a group of parts requiring surface finishing have the same family characteristics.

The equipment illustrated above takes advantage of this family trait and surface broaches five operations on *twenty* different chuck jaws. Only one ram of the machine—a CINCINNATI No. 10-66 Vertical Duplex Hydro-Broach—was tooled for production, but the results were so satisfactory that the other ram was later tooled for subsequent machining operations on chuck jaws. The equipment includes a three-station fixture with interchangeable locating and clamping details to accommodate all the parts.

Actual production, on a test run, was increased to 150 jaws per hour, averaging nearly 14 times the production obtained by the previous process.

Perhaps there are "families" in your own shop which could be machined much faster on a CINCINNATI Vertical Hydro-Broach Machine. Our engineers will gladly give you their recommendations.



CINCINNATI No. 5-42 Duplex Vertical Hydro-Broaching Machine Catalog M-894 covers the complete duplex line.



THE CINCINNATI MILLING MACHINE CO. CINCINNATI, OHIO, U.S.A.

TOOL ROOM AND MANUFACTURING MILLING MACHINES... SURFACE BROACHING MACHINES... DIE SINKING MACHINES

For These Things We Now Fight . . .

By K. T. Keller
President, Chrysler Corporation

TREMENDOUS economic problems are certain to follow this war. Practically the whole world will have to be rebuilt and restored. Here in the United States we have resources and strength to tackle that job.

What can industry do about it? Many things:

It can keep its production machinery in good running order.


It can raise its sights to perhaps the greatest desire for useful products the world has ever seen.

It can take the new skills learned in defense production, the new metallurgy, the new chemistry, the new discoveries, the new materials, the new inventions, the new economies, which have been developed for war and adapt them to making new products—products that are better, more desirable and cheaper for public benefit and use.

It can engage in the research that is necessary to develop these things commercially and do it without interfering with the research that must go on to improve our weapons of war.

It can get ready to convert itself quickly to the manufacture of desired and appealing products.

It can anticipate these developments now and try to avoid the necessity of getting peace-time production under way at the eleventh hour when the demand may be already upon us.

Abstract of an address before the Congress of American Industry of the N.A.A. 

THOUGHTS appropriate to the season, in war time as in peace time, are expressed in these words of K. T. Keller. Looking forward clearly with calmness and confidence—planning intelligently with sound and courageous optimism is good for our present morale. It is assuring as to our future welfare. It gives us greater strength to overcome obstacles immediately before us and will help us build a better world for days to come. America has many things to fight for. We will fight for them with every ounce of our tremendous might unshakably convinced that there are ahead, for America and Americans, Many Happy New Years.—J. C.

To do all this intelligently there are naturally some questions to which the answers are not now clear.

Perhaps it is too much to expect even an intelligent opinion today of the post-war economic situation.

How long and how intense will be the diversion to defense of our accumulated wealth and income?

When eventually the present international economic earthquake has subsided, and we survey the damage and plan the new future, how much of the then income dollar will be taken for taxes—municipal, state and federal?

How much of the income dollar of the post-war wage earner, the investor, the professional man, the farmer, will be available for needs and wants in post-war goods?

Will industry be allowed to work out its problems under a free enterprise system?

The essentials of the system of free enterprise under which

this country has grown to world leadership and under which 130 million people live better, have more comforts and pleasures than any others, I find stated simply and clearly in a set of basic principles formulated by a group of economists for your consideration.

These state that our economic organization is one in which:

First: Individuals engage in activities for the purpose
(Turn to page 78, please) •

*This is the Sixty-sixth
in the series of monthly
production features*

CONFIDENCE in the future of supercharged engines for heavy duty vehicles has been responsible, at least in part, for the development of a line of unique Roots type superchargers by the McCulloch Engineering Co., suitable for heavy duty gasoline and Diesel engines. Although most of the output is taken currently for national defense, R. G. McCulloch, president of the company, has visualized the development of super-

By JOSEPH GESCHELIN

charged powerplants for high performance motor vehicles and has laid plans for encouraging this trend and for cooperating in the movement at an opportune time.

Meanwhile, the company has just begun operations in a new plant in Milwaukee. This is an outstandingly modern plant of single-story construction, with high ceiling providing fine ventilation, excellent daylight seeing, and unusually good artificial lighting through the medium of fluorescent light sources providing 35 foot-candle intensity at work places. An interesting feature of the machine shops is the housing of all wiring and power lines under the floor, leaving the space overhead clear of all wiring and piping. Power for the machine tools is obtained by plugging directly into floor outlets.

At the present writing the building has a floor space of 32,500 sq. ft. which is adequate for current requirements. However, the company owns the adjoining property to the rear of the building and Mr. McCulloch contemplates the possibility of expanding the building many-fold in the future.

Specialization in supercharger design, stemming from a successful experience with the manufacture of boosters for Ford V-8 engines has resulted in a skillful development of a line of standardized units with the maximum degree of interchangeability of small parts and of major elements of each type. By coordinating

General view in the final assembly department showing the arrangement of assembly benches. The Gisholt Dynamic balancing machine is located in this department.

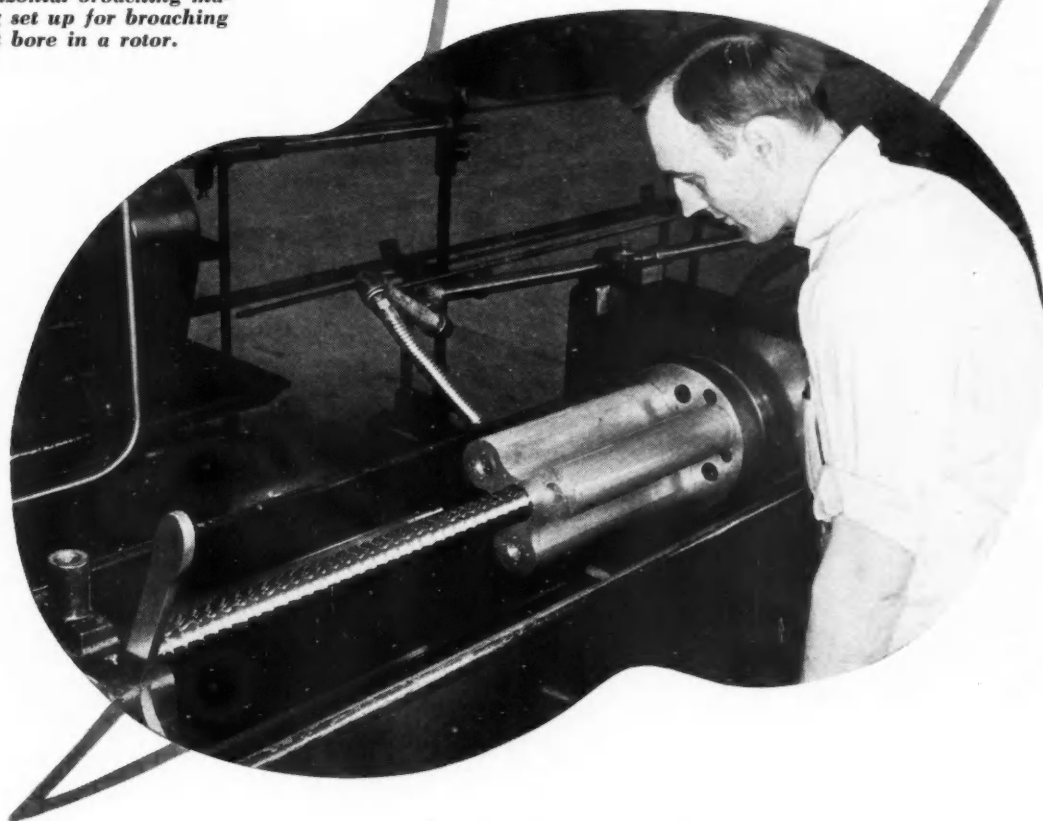


McCulloch S

(Below) General view of the excellently laid out and well equipped tool room. The equipment in this department is outlined in the text.

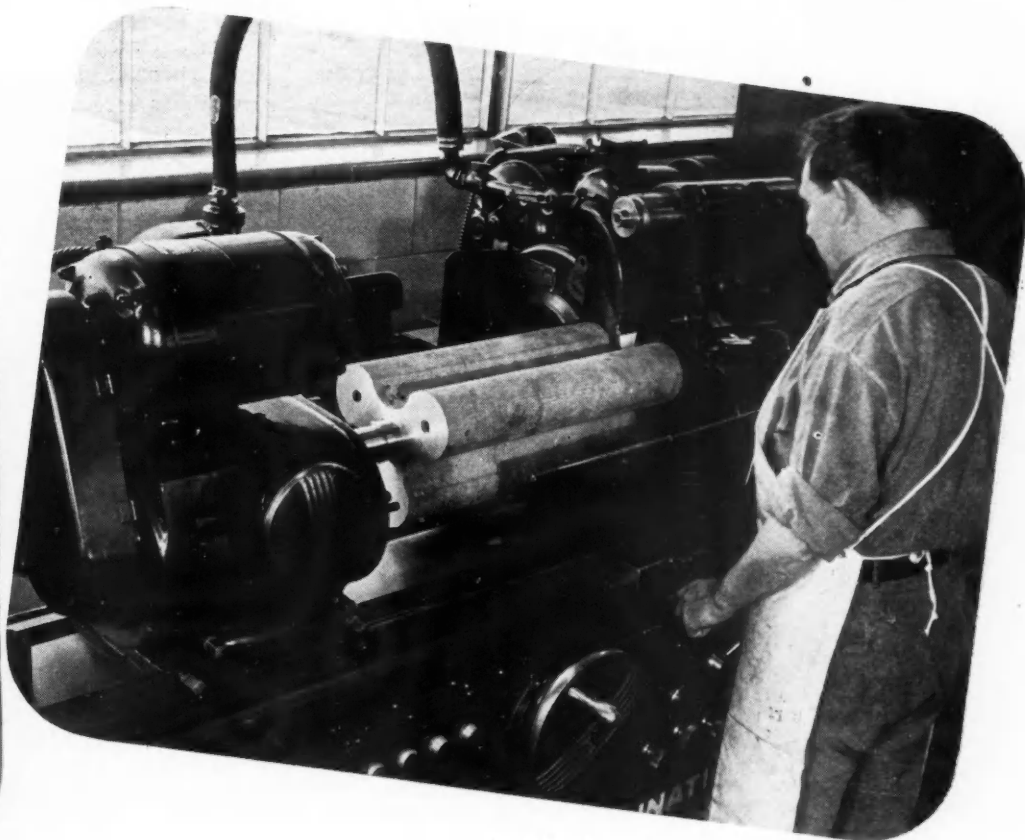


American horizontal broaching machine showing set up for broaching the shaft bore in a rotor.

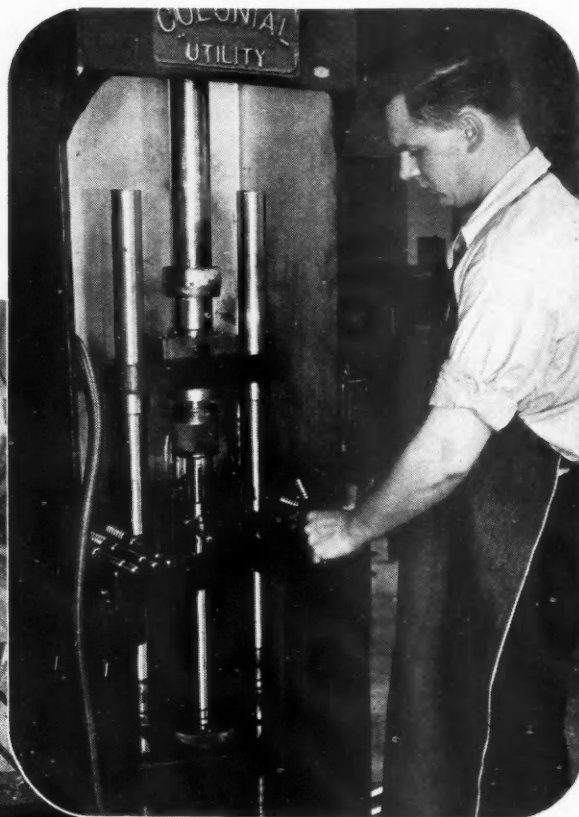
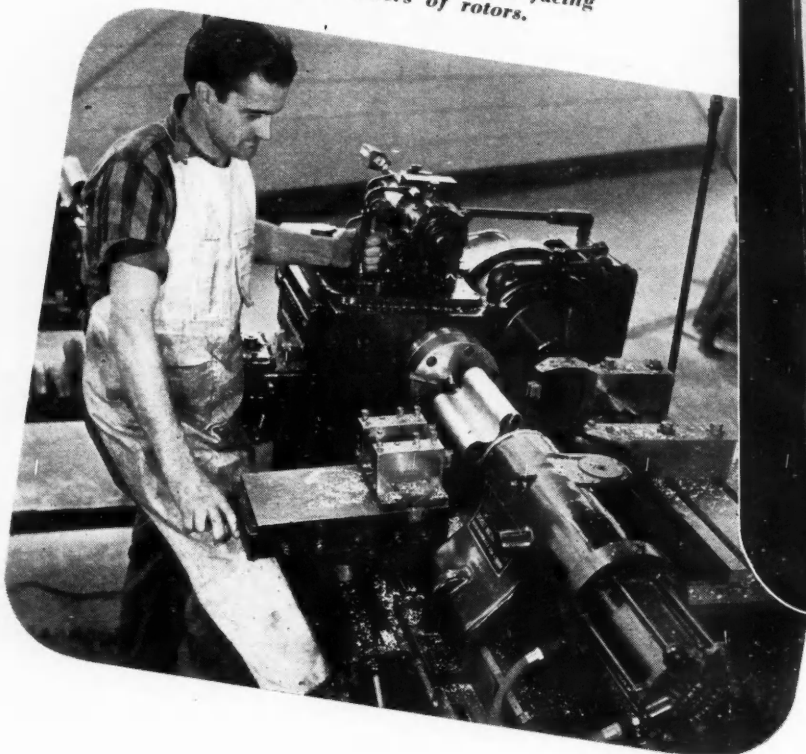


Superchargers in the Making

(Right) Finish - grinding bearing diameters and front and end seal diameters on a Cincinnati grinder.



This is the No. 12 Gisholt automatic lathe, tooled for machining both rotors and rotor shafts. Shown here is the set up straddle-facing wings and facing bearing shoulders of rotors.



A close-up of the 24 in. Colonial Utility broaching machine set up for broaching short internal splines which are cut in six different operations.

these engineering principles with production planning it has been possible to achieve an extremely simple and flexible manufacturing set-up, capable of making best use of the available floor space.

It may be noted briefly that the McCulloch line consists of 12 standard sizes of superchargers, made in three series. The No. 4000 Series has a standard center distance of 4 in., rotor lengths of 5½, 7, 9 and 12 in. The No. 5500 Series with a center distance of 5½ in., provides rotor lengths of 7½, 9, 11, 14 and 18 in. The No. 7500 Series with a center distance of

7½ in., has rotor lengths of 12, 16, and 21 in.

Rotors are of straight, three-lobed design in combination with helical inlet and outlet ports. It is said that these elements combine to bring about a notable decrease in noise level. The rotors are of aluminum alloy permanent mold castings, intricately cored and held accurately to size so as to reduce metal removal to the very minimum.

Some of the other materials used in the construction of these units are rather unique and worth noting. For example, the housings are made of aluminum sand

Factory Routing—Machining of Rotor

OPERATION AND EQUIPMENT

CHUCK in special fixture, bore hole to 1.3755-1.374

Gisholt No. 5 turret lathe

BROACH hole in wing

American broach

INSPECT

At this point shaft and rotor become an assembly.

SHRINK rotor to shaft, maintaining 17/32 step on smooth end

LAP centers

Ex-Cell-O centering machine

STRADDLE FACE wings to 5.506-5.510. Face bearing shoulder to 0.600-0.604 from front face of wing

Gisholt No. 12 automatic lathe

FINISH GRIND bearing diameters 1.1808 and 1.1812 also front end seal diameter 1.375

Cincinnati grinder

ROUGH MILL contour on lobes to semi-finish 2.086-2.084

Kearney & Trecker Simplex mill

FINISH MILL contour on lobes to 2.055

Simplex mill

Finish **STRADDLE FACE** ends to 5.473-5.474 and turn

O.D. to 5.982-5.983

Gisholt No. 12 automatic lathe

MILL 3/32 in. groove in wing lobes

2K Kearney & Trecker milling machines

DRILL and **REAM** taper pin hole

Edlund drill

MILL keyway in shaft

2H Kearney & Trecker mill

BORE 6 carbon seal holes 1.845-1.846

Ex-Cell-O double end boring machine

MILL 6 carbon seal slots 0.126-0.125

Hand mill

BALANCE

INSPECT

Factory Routing—Machining of Rotor Housing

OPERATION AND EQUIPMENT

ROUGH STRADDLE face ends 9.020-9.024
Duplex Kearney & Trecker mill

Put in rough dowel pin holes, one end only. Drill 21/64 in., ream 11.32 in., 1/2 in. deep
Edlund drill

STRADDLE MILL and broach ports 8.500-8.490. Locate from dowel holes
Duplex Kearney & Trecker mill

ROUGH BORE housing 5.979-5.980
Heald No. 49 Bore-Matic

DRILL 28 end holes
Natco multiple drill

COUNTERSINK 28 end holes 3/8 in. dia.
Edlund drill

TAP 28 end holes 5/16-18 3/4 in. deep
Bakewell taper

DRILL 24 port holes 5/16 in., 7/8 in. deep
Natco multiple drill

COUNTERSINK 24 holes 7/16 in. dia.
Edlund drill

TAP 24 holes 3/8-16
Bakewell taper

NORMALIZE when necessary

FINISH GRIND to length 9.000-8.999

Ends must be flat and parallel
Blanchard surface grinder

FINISH BORE 6.000-5.999
Heald No. 517 Bore-Matic

ROUGH DRILL dowels, both ends, 23/64 in.
Edlund drill

FINISH BORE dowel holes, both ends, 0.3746-0.3752
Heald Bore-Matic

INSPECT

castings. End plates are of Ni-resist, high-nickel alloy iron, to provide for uniform expansion of the aluminum assembly. The gear set consists of two gears—one of SAE 4640 steel, the other of No. 18 Ampco bronze, both blanks being drop-forged—the use of dissimilar metals being intended to compensate for the expansion of the gear centers. This eliminates back-lash at elevated temperatures and makes it possible to hold closer tolerances throughout the unit without danger of rotor interference. The rotor shaft is machined from LaSalle No. 2 stressproof steel.

From a production standpoint, it is of interest that the program of design simplification makes it possible to use many small parts interchangeably; also makes possible the use of the same end plates and gear sets for every size in the same series.

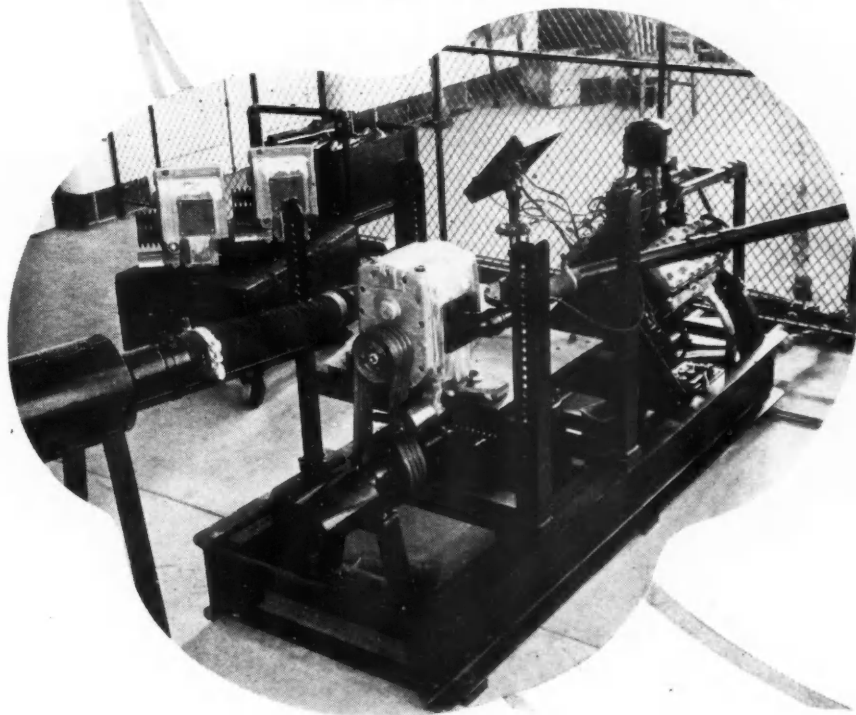
Coming to the details of the manufacturing set-up, we find that the plant has been equipped with a total of 75 of the latest types of machine tools of the familiar makes listed in detail in the table on page 22. This does not include special test equipment, inspection devices, etc. Among the items not listed is one of the latest Sheffield gages with 5000 to 1 magnification.

Generally speaking the plant is divided into centralized departments, including—a gear department, precision boring machine department, lathe group, drilling and tapping group, assembly, testing, and final inspection. A high-spotting of the routings of a few of the major parts will enable the reader to visualize the entire layout.

However, before proceeding with the routings let us note that this organization has given care-

ful attention to the most economical utilization of special cutting tools. Too, it is noteworthy that they have drawn upon the facilities of many of the outstanding suppliers in this field. For example, the fly-cutters for contour-milling (finish-milling) the rotors are made of Ramet. In addition, Ramet is used for all non-ferrous precision-boring operations. In the turret lathe department, Kennametal is used on the Gisholt lathes on all steel cutting operations, also on other machines for steel cutting. The only exception in the lathe department is found in the case of the No. 12 Gisholt automatic lathe. This has been tooled for machining the O.D. and length of rotors as well

Close-up of one of the production test stands, showing an assembled unit ready for run-in driven by a Ford V-8 engine. The connection to the intake port silencer may be seen at the left.



Machine Tool Equipment

MILLING MACHINES

Kearney & Trecker No. 1236 Simplex
Kearney & Trecker No. 1236 Simplex
Kearney & Trecker No. 1848 Simplex
Kearney & Trecker No. 2H Plain
Kearney & Trecker No. 2H Plain
Kearney & Trecker No. 1842 Duplex
Hand Mill
Kearney & Trecker No. 2H Universal
Kearney & Trecker No. 2K Plain
Kearney & Trecker No. 2K Vertical
Kearney & Trecker No. 3K Universal

TURRET LATHES

Gisholt No. 3
Gisholt No. 5
Gisholt No. 4
Gisholt No. 4

GRINDERS

No. 18 Blanchard surface
6 in. x 30 in. Norton Cylindrical
6 in. x 30 in. Cincinnati Model EA
cylindrical
10 in. x 36 in. Cincinnati Model EA
cylindrical
No. 55 Grand Rapids surface grinder
No. 46C Excella carbide tool grinder
Delta pedestal tool grinder
Cincinnati Tool and Cutter Grinder
Oliver Drill Pointer
Kearney & Trecker Face Mill Grinder
Cincinnati 12 in. x 48 in. Universal
Grinder

Sioux 6 in. Bench Grinder
Barber-Colman Combination Hob and
Cutter Sharpening Machine

ENGINE LATHES

12 in. x 30 in. Hendey
16 in. x 54 in. Hendey
24 in. x 72 in. Hendey
16 in. x 30 in. South Bend
13 in. x 30 in. South Bend
LeBlonde 18 in. x 48 in.
South Bend 16 in. x 8 ft.
South Bend 18 in. x 7 ft.

AUTOMATIC LATHES

No. 12 Gisholt
No. 6 in. Sundstrand

BALANCING EQUIPMENT

Gisholt "Dynertric" Dynamic balancing
machine

GEAR DEPARTMENT EQUIPMENT

Barber-Colman Type A hobbing ma-
chine
Fellows No. 8 gear shaving machine
Illinois Tool No. 224 involute checker
Michigan Tool helical lead checker 12
in.
No. 365 Illinois tool hob checking unit
18 in. Red Ring gear speeder

MISCELLANEOUS MACHINES

Hendey 24 in. shaper
Peerless power saw

Sundstrand centering machine
Hisey double end grinder
Delta pedestal grinder
Excella center lapping machine
No. 2F Norton lapping machine
Bakewell No. 1 tapping machine

BORING MACHINES

Double end Excella
No. 49 Heald Bore-Matic
No. 48A Heald Bore-Matic
No. 48A Heald Bore-Matic
No. 48A Heald Bore-Matic
No. 48A Heald Bore-Matic
Heald tool sharpener
Cincinnati Bickford job borer
No. 41 Lucas horizontal boring bar

BROACHING MACHINES

Colonial 24 in. vertical broach
American 15-ton horizontal broach

DRILLING MACHINES

Fosdick 24 in. single spindle
American 36 in.—12 speed radial
Two-spindle 17 in. Delta
Two-spindle 17 in. Delta
Two-spindle 15 in. Edlund
Multiple-spindle No. 2 BL Natco
17 in. floor model Delta
15 in. bench model Walker Turner
25 in. Cleereman
36 in. American radial
25 in. Cincinnati Bickford drill

as the turning of rotor shafts. It is tooled with Carboloy, using two different types of tips—one suitable for steel cutting, the other for aluminum.

Carboloy also is used for the inserted blades of the

big 14 in. milling cutters, for face-milling the ends and ports of the aluminum housings in the Kearney & Trecker Duplex milling machine.

Quality control is an important part of the activity. The entire assembly, although it appears to be rather simple mechanically, is extremely fussy as to precision tolerances, close clearances between the rotor and the case, gear centers, back-lash of gears, end clearance of the rotor, etc. Accordingly all parts are inspected with unusual care to assure conformity to specifications and complete interchangeability not only for factory assembly but in field service as well. As one element of quality control, they have four sets of Johansson gage blocks for checking tools and gages and for use in the tool room. The Gisholt Dynertric balancer is another important inspection device employed here. It is installed in the final assembly department for the dynamic balancing of all rotors.

Another feature combining nicety of design and execution is the precise "timing" of supercharger assemblies. The method employed here is said to be unique, provides interchangeability even in field replacements. It is achieved with two steps—the cutting of a keyway in the rotor shaft for the proper alignment of the driving gear; and the cutting of a corresponding keyway in the gear. In each case the key to the operation is a specially designed fixture for holding and locating the work-piece.

In the case of the rotor assembly, the rotor lobes are aligned precisely in the fixture, and the work then is securely clamped ready for keyseating, owing to the provisions for this purpose in the design of the fixture. Moreover, the keyseating tool is guided accurately by means of Carboloy ways fitted on each side of the slot.

The fixture for keyseating the gear is designed for application on the American broaching machine. The



Natco multiple-spindle drill set up for drilling housings and end plates.

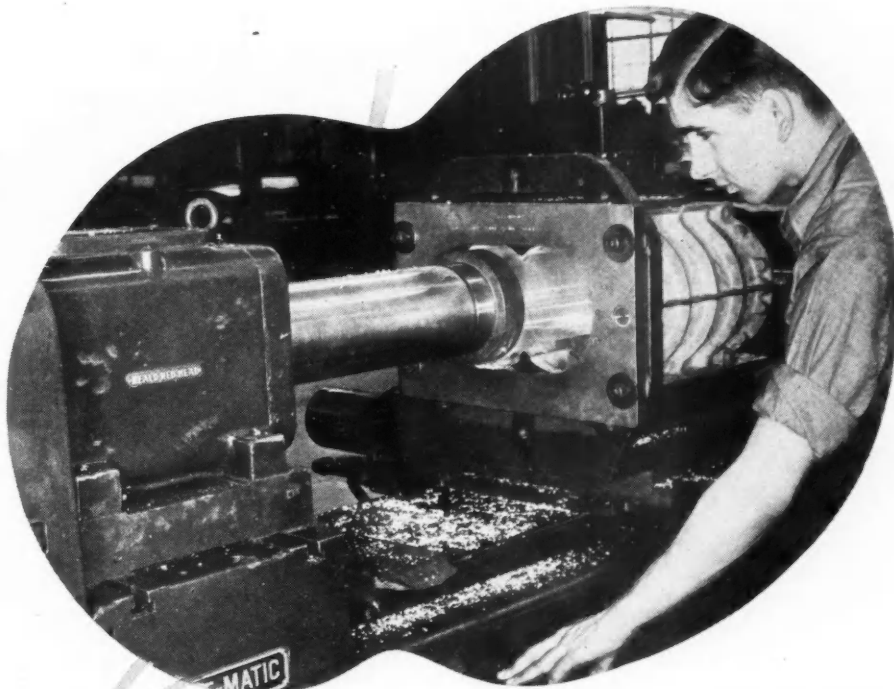
gear is aligned with respect to a given reference point, held securely by means of a finger which fits into the proper tooth space. The key-way is cut by means of a pull-broach.

Rotor Machining

The rotor is machined in accordance with the routing given in table on page 20.

In going over these steps, it may be noted that the first or rough-milling operation is done with a special h-s-s form milling cutter which mills the contour in three indexings. Finish-milling is done with a special tool fitted with fly-cutter inserts of Ramet. The carbon seal holes in the ends of the rotor lobes are precision-bored on a double-end Ex-Cell-O boring machine.

One operation, not noted on the routing, is that of coating the rotor lobes with a special plastic material which is sprayed on, then baked. The function of the plastic coating is to take up all of the clearance between the rotor and housing, the interference within the assembly being eliminated by rubbing off the excess surface coating during the



A working "shot" of a massive Heald Bore-Matic boring the two housing bores in two indexings of the fixture.

initial running-in on the test stand.

Rotor Housing

The machining of this major element is given in the routing on page 21.

The first operation is that of straddle-facing the ends in a special fixture, holding two pieces at a time. Milling cutters used on this operation are 14 in. in diameter with inserted teeth tipped with Carboloy. Later the two principal bores of the housing are rough-bored in a Heald Bore-Matic, using Ramet-tipped tools. These are finish-bored in another of the Heald Bore-Matics.

The ends of the housing—held flat and parallel for precise end clearance conditions—are ground to length in a Blanchard No. 18 surface grinder. The same machine also is used for grinding the end plates. Since the housings are of aluminum, whereas the end plates are of Ni-Resist, these parts are put through in separate lots with a different type of wheel to suit each material.

To facilitate assembly of



Perspective in the gear department—left foreground is the No. 8 Fellows gear shaver; right foreground, Type A Barber-Colman hobbing machine; right rear, the Red Ring gear speeder; next in order from right to left—Illinois tool hob checker, Illinois involute checker, and the 12 in. Michigan Tool helical lead checker.

Factory Routing—Finishing of Gears

OPERATION AND EQUIPMENT

CHUCK I.D., ROUGH TURN O.D. to 4.155-4.160 face front face of gear and hub, **ROUGH TURN O.D.** of hub to 1.795-1.800, **UNDER CUT** relief at pilot dia. to 2 in. O.D. x 1/32 deep, **DRILL** 1 1/8 in., **BORE** 1.1801 hole to 1.160-1.165, **CHAMFER** bore 3/64 x 45°, break all sharp corners
Gisholt turret lathe

CHUCK on O.D., **FACE** hub and run of gear, leaving 0.030-0.035 stock over all, **COUNTER BORE** 3.500-3.490 **BORE** to size and depth, recess groove 3.555-3.565 dia. to size and width
Gisholt turret lathe

CHUCK O.D., SEMI-FINISH BORE to 1.176-1.177
Heald Bore-Matic

CHUCK O.O., FINISH BORE to size, 1.1797-1.1801
Heald Bore-Matic

Press on arbor, **FACE** front face and **BACK FACE** of hub to finished dimensions, break sharp corners, finish turn O.D. of hub to size, 1.7810-1.7815
Lathe

FINISH TURN O.D. to size and **FACE** gear to width
Sundstrand stub lathe

DRILL 4 holes, "Q" drill, **COUNTERSINK** 13/32 x 45°
Delta drill

TAP 4 holes, 3/8-24
Bakewell tapper

INSPECT

HOB gear
Barber-Colman hobber

BURR gear teeth
Hand file

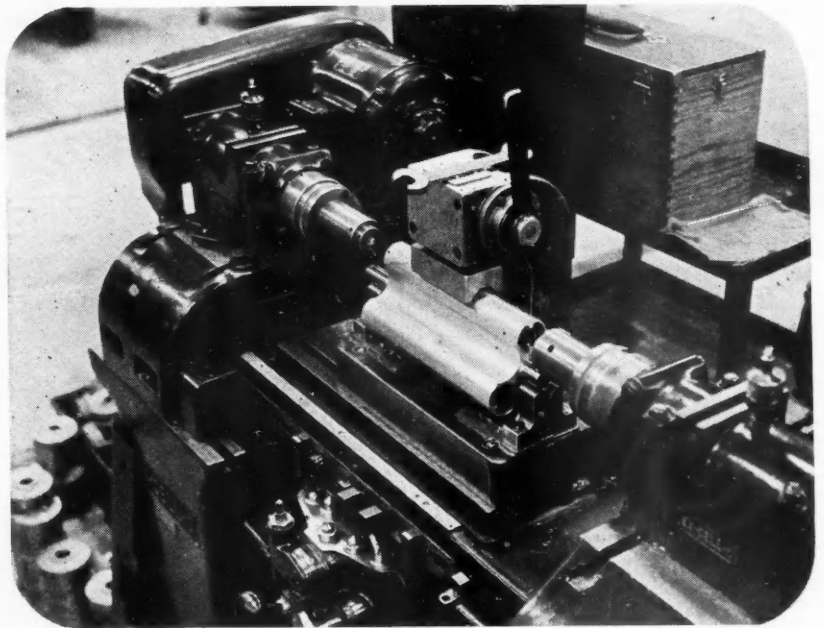
SHAVE
Fellows enveloping gear finisher

BROACH keyway 0.3120-0.3122
American broach

INSPECT
Machine Tool Equipment—Catch

the unit, the surface grinding operation is supplemented with a Norton rotary table, lapping machine on which the housings, end plates, and other flat parts, are lapped, if necessary to provide a leak-proof joint.

The last operation, that of finish-boring the two dowel holes, is quite interesting, not only because of the obviously fine alignment of the end plate due to accurate doweling, but also because of the design of the boring machine. This Heald Bore-Matic is provided with three
(Turn to page 74, please)



(Above) Ex-Cell-O double-end precision boring machine boring the six carbon seal holes.



(Left) Straddle-milling the port faces of the housings in a Kearney & Trecker Duplex mill.

Brazing Carbide Tips on Tools

Methods Outlined by a Tip and Tool Maker and an Automobile Manufacturer

WITH the tremendous increase in the usage of cemented carbide tools and the possibility of delays in obtaining them, to avoid this emergency condition some manufacturers are now brazing carbide tips to shanks milled in their own departments. Carbide tips are reported to be readily obtainable from producers. To assist manufacturers using its products, the Carboloy Co., Inc., recommends the following torch brazing procedure:

A "sandwich" braze, as shown in Fig. 1, should be used for tools with tips of $\frac{3}{4}$ in. or more, and also for irregularly shaped tips. This type of braze differs from the ordinary braze mainly in that a constantan sheet is inserted between double layers of Easy-Flo No. 3 and Handy-Flux. The "sandwich" braze is also recommended when tools are produced from tips of such grades as 999, 881 or 78, regardless of the tip size used.

In applying heat,

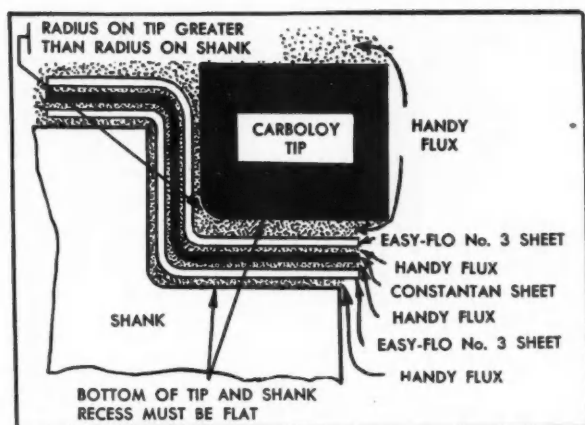


Fig. 1

(Fig. 1) This "sandwich" braze is recommended for Carboloy tips.

(Fig. 2) The torch flame.

(Fig. 3) Location of flame on the shank for melting brazing wire.

(Fig. 4) Completing the brazing operation.

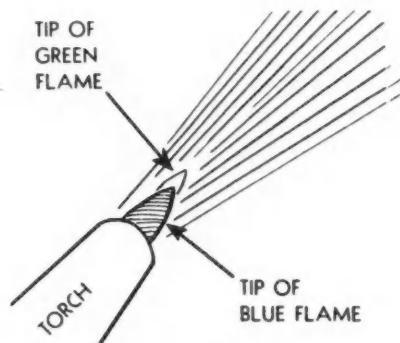


Fig. 2

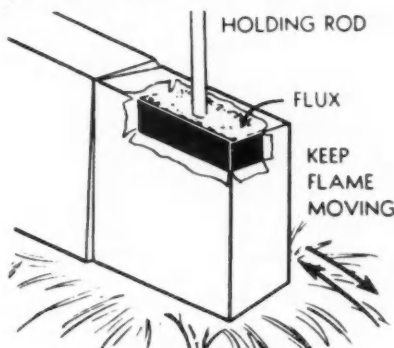


Fig. 3

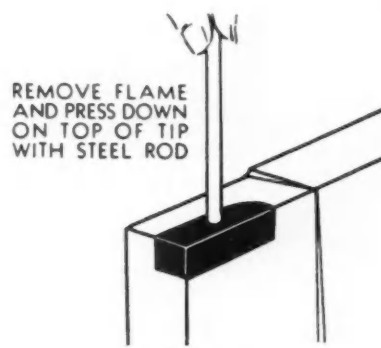


Fig. 4

Buick developed this setup to manufacture its own Carboloy tools.



the torch should be adjusted as shown in Fig. 2 to avoid oxidation. To assure uniformity of heat distribution beneath the tip, the torch should be applied, as shown in Fig. 3, until the Easy-Flo No. 3 is molten, flows freely, and wets the tip. The flame should be kept moving back and forth to avoid burning the steel. The tip should be held in place with a steel rod for a short period to allow the braze to set, Fig. 4.

When brazing shanks $\frac{3}{4}$ inch square or larger, it is desirable to equalize the temperature by preheating the shank. This is best done by applying the flame to the bottom and sides of the shank and finally to the tip to complete the braze.

When it is necessary, due to tip location, to fill in crevices or build up a brazed backing on the

(Turn to page 80, please)

Factory Routing—Finishing of Gears

OPERATION AND EQUIPMENT

CHUCK I.D., ROUGH TURN O.D. to 4.155-4.160 face front face of gear and hub, **ROUGH TURN O.D.** of hub to 1.795-1.800, **UNDER CUT** relief at pilot dia. to 2 in. O.D. x 1/32 deep, **DRILL** 1 1/8 in., **BORE** 1.1801 hole to 1.160-1.165, **CHAMFER** bore 3/64 x 45°, break all sharp corners

Gisholt turret lathe
CHUCK on O.D., **FACE** hub and run of gear, leaving 0.030-0.035 stock over all, **COUNTER BORE** 3.500-3.490 **BORE** to size and depth, recess groove 3.555-3.565 dia. to size and width

Gisholt turret lathe
CHUCK O.D., SEMI-FINISH BORE to 1.176-1.177

Heald Bore-Matic
CHUCK O.D., FINISH BORE to size, 1.1797-1.1801

Heald Bore-Matic
Press on arbor, **FACE** front face and **BACK FACE** of hub to finished dimensions, break sharp corners, finish turn O.D. of hub to size, 1.7810-1.7815

Lathe

FINISH TURN O.D. to size and **FACE** gear to width
Sundstrand stub lathe

DRILL 4 holes, "Q" drill, **COUNTERSINK** 13/32 x 45°
Delta drill

TAP 4 holes, 3/8-24
Bakewell tapper

INSPECT

HOB gear
Barber-Colman hobber

BURR gear teeth
Hand file

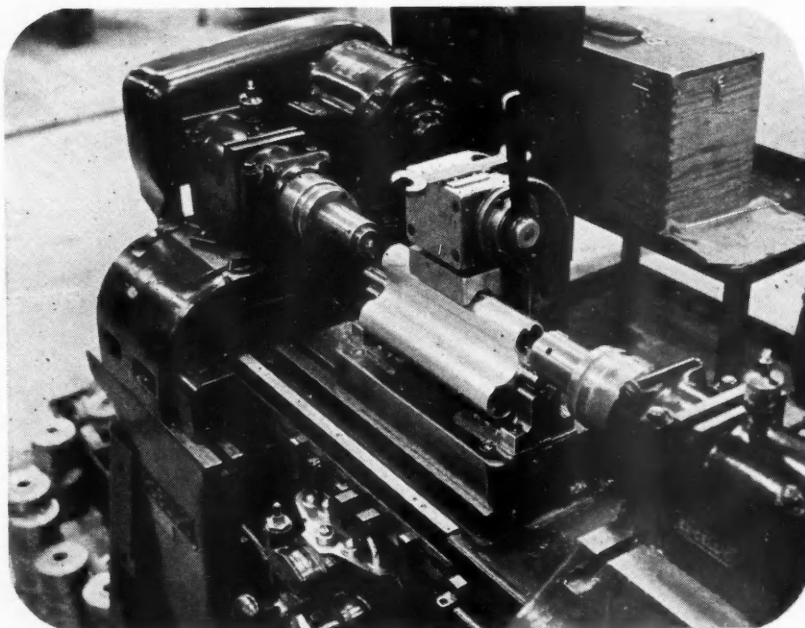
SHAVE
Fellows enveloping gear finisher

BROACH keyway 0.3120-0.3122
American broach

INSPECT
Machine Tool Equipment—Catch

the unit, the surface grinding operation is supplemented with a Norton rotary table, lapping machine on which the housings, end plates, and other flat parts, are lapped, if necessary to provide a leak-proof joint.

The last operation, that of finish-boring the two dowel holes, is quite interesting, not only because of the obviously fine alignment of the end plate due to accurate doweling; but also because of the design of the boring machine. This Heald Bore-Matic is provided with three
(Turn to page 74, please)



(Above) Ex-Cell-O double-end precision boring machine boring the six carbon seal holes.



(Left) Straddle-milling the port faces of the housings in a Kearney & Trecker Duplex mill.

Brazing Carbide Tips on Tools

Methods Outlined by a Tip and Tool Maker and an Automobile Manufacturer

WITH the tremendous increase in the usage of cemented carbide tools and the possibility of delays in obtaining them, to avoid this emergency condition some manufacturers are now brazing carbide tips to shanks milled in their own departments. Carbide tips are reported to be readily obtainable from producers. To assist manufacturers using its products, the Carboloy Co., Inc., recommends the following torch brazing procedure:

A "sandwich" braze, as shown in Fig. 1, should be used for tools with tips of $\frac{3}{4}$ in. or more, and also for irregularly shaped tips. This type of braze differs from the ordinary braze mainly in that a constantan sheet is inserted between double layers of Easy-Flo No. 3 and Handy-Flux. The "sandwich" braze is also recommended when tools are produced from tips of such grades as 999, 881 or 78, regardless of the tip size used.

In applying heat,

Buick developed this setup to manufacture its own Carboloy tools.

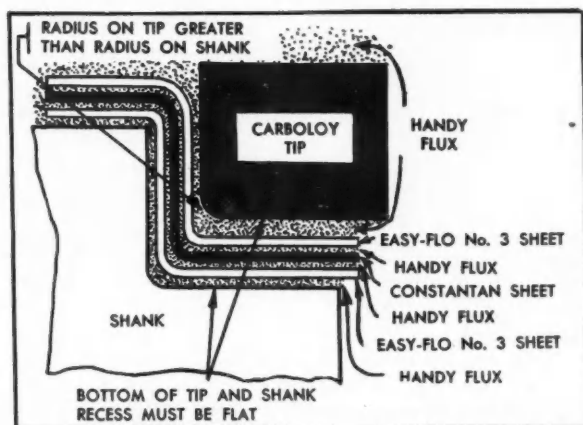
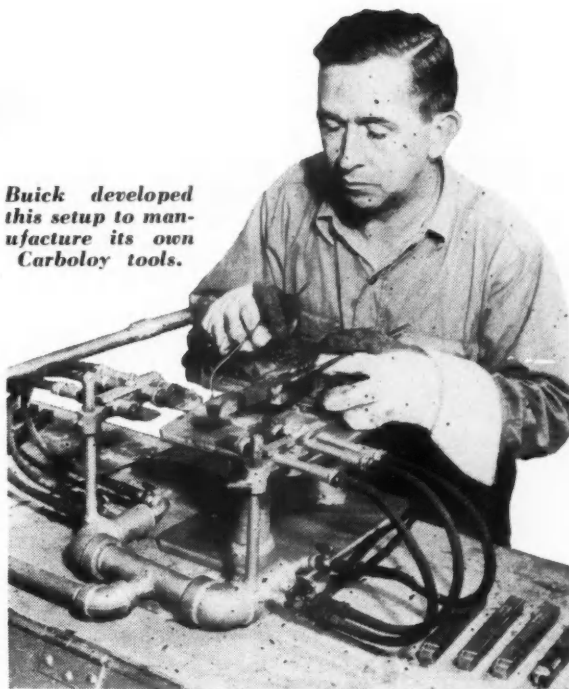


Fig. 1

(Fig. 1) This "sandwich" braze is recommended for Carboloy tips.

(Fig. 2) The torch flame.

(Fig. 3) Location of flame on the shank for melting brazing wire.

(Fig. 4) Completing the brazing operation.

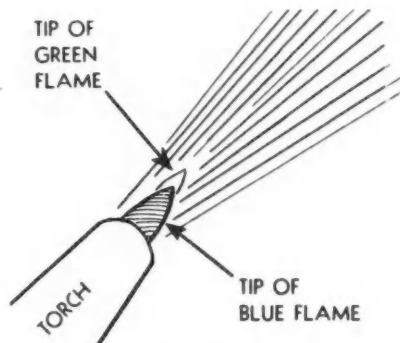


Fig. 2

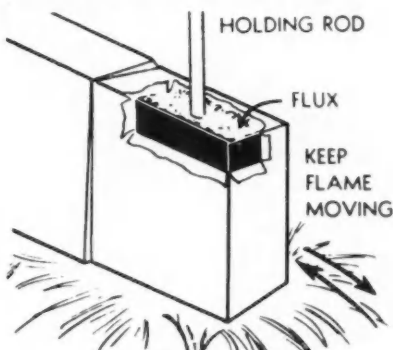


Fig. 3

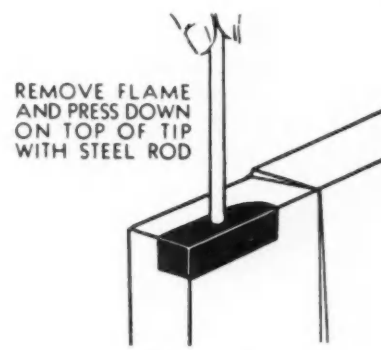


Fig. 4

the torch should be adjusted as shown in Fig. 2 to avoid oxidation. To assure uniformity of heat distribution beneath the tip, the torch should be applied, as shown in Fig. 3, until the Easy-Flo No. 3 is molten, flows freely, and wets the tip. The flame should be kept moving back and forth to avoid burning the steel. The tip should be held in place with a steel rod for a short period to allow the braze to set, Fig. 4.

When brazing shanks $\frac{3}{4}$ inch square or larger, it is desirable to equalize the temperature by preheating the shank. This is best done by applying the flame to the bottom and sides of the shank and finally to the tip to complete the braze.

When it is necessary, due to tip location, to fill in crevices or build up a brazed backing on the

(Turn to page 80, please)

Use of the Oscillograph

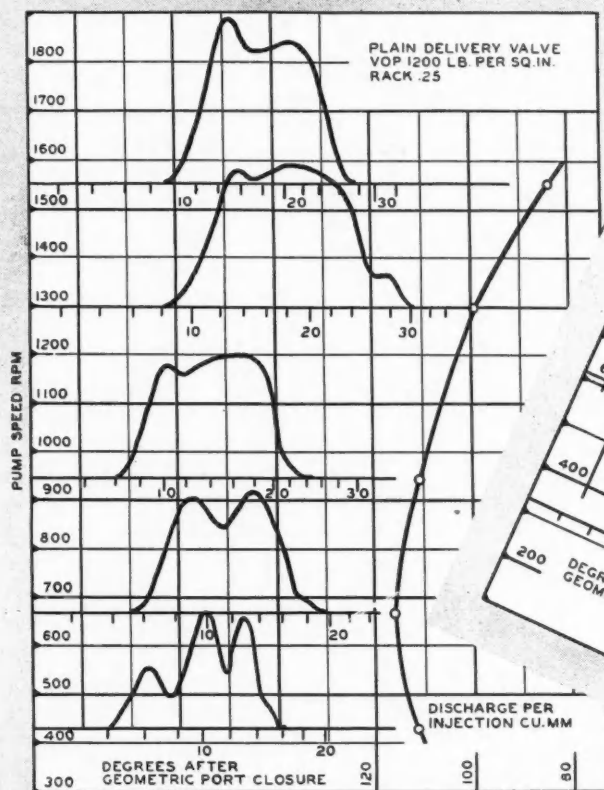


Fig. 1. Needle-lift diagrams of normal port-controlled pump.

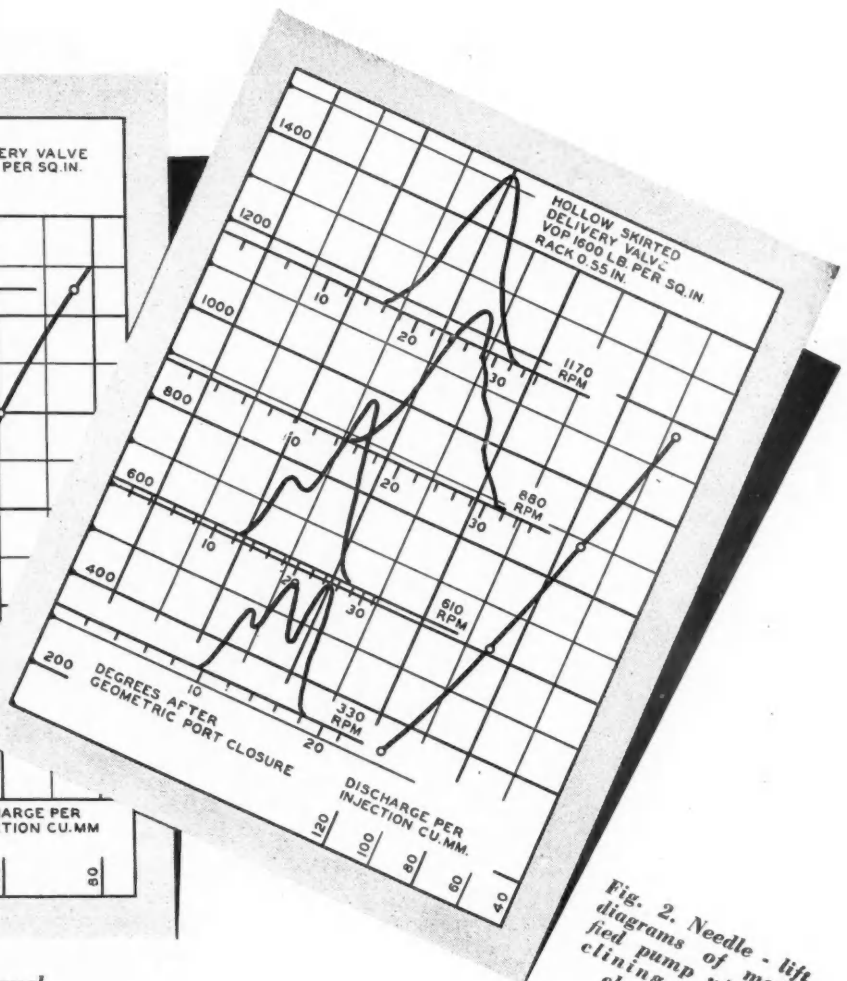


Fig. 2. Needle-lift diagrams of modified pump with declining delivery characteristics.

IN TESTS of injection systems, the cathode-ray oscillograph has been found to give the quickest and most informative results. Of course, certain phases of routine testing can be performed without special instruments. Thus, the valve-opening pressures of the nozzles, the seating conditions of the nozzle valves, the appearance of the spray, and the uniformity of pump metering and of the geometric timing can be checked with very simple means. These, however, are not sufficient to judge the suitability of an injection system for a particular application. A needle-lift dia-

By P. H. SCHWEITZER*

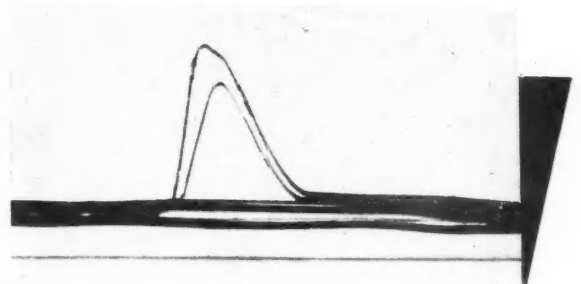


Fig. 3. Needle-lift diagram of slightly-irregular injection.

* The Pennsylvania State College.

for Testing Fuel Injection

gram showing the travel of the nozzle-valve stem relative to pump-shaft rotation will reveal additional pertinent information, such as the actual injection timing at various speeds and loads, the duration of and irregularities in the injection.

Fig. 1 shows needle-lift diagrams of a normal, port-controlled pump with a pintle-type nozzle at various speeds. Fig. 2 shows similar diagrams obtained with the same pump slightly modified to give a declining delivery characteristic.

Fig. 4. Needle-lift diagrams of an experimental pump. At 800 and 1000 rpm. Bad secondaries.

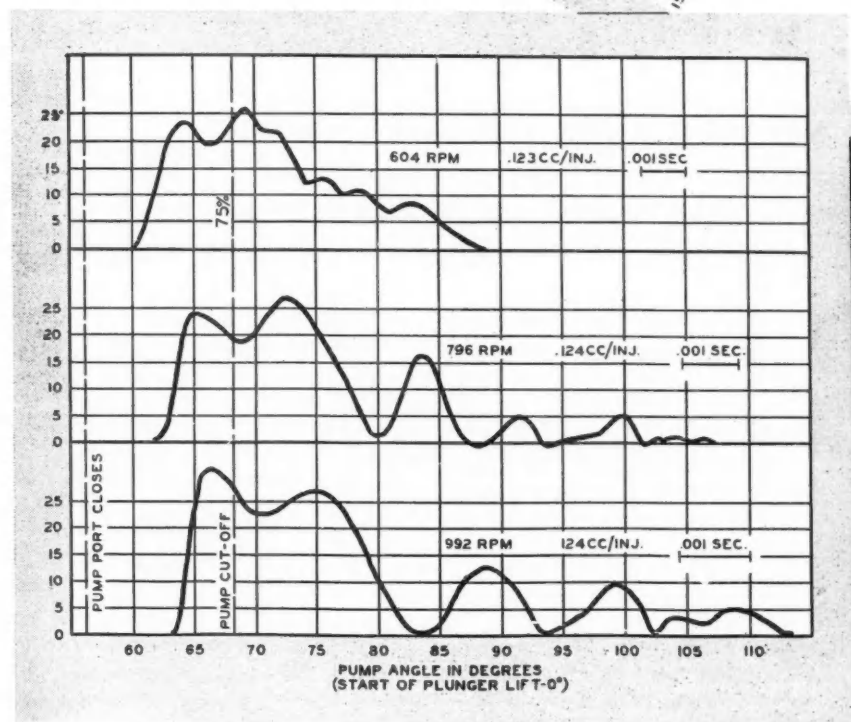


Fig. 5. Line-pressure diagrams near the pump (P.) and near the nozzle (N), needle lift diagram (N) and pump-delivery valve diagram (D.V.).

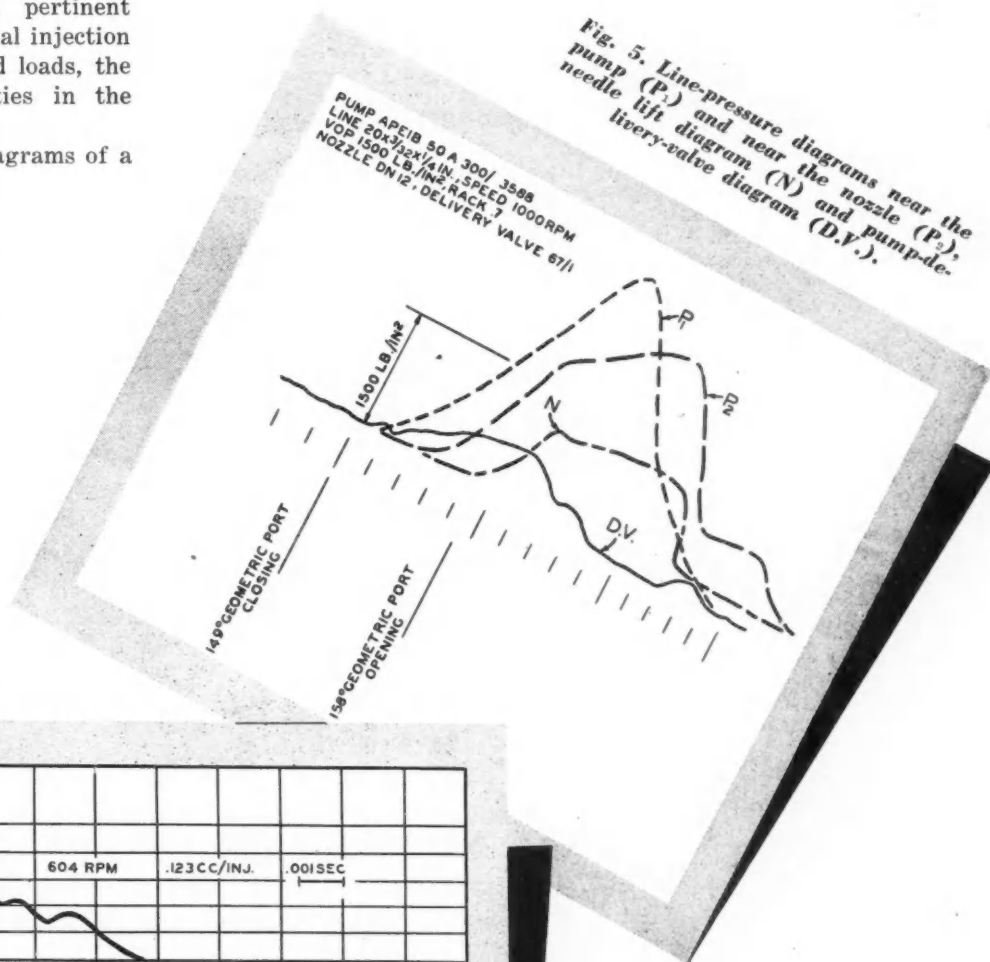


Fig. 3 shows slightly irregular injection, every other injection being smaller. Fig. 4 shows bad secondaries that cause smoking. The rate-of-discharge curve as determined with the slotted-disk machine does not always check exactly with the needle-lift diagram but—except in special cases—the latter is a good-enough

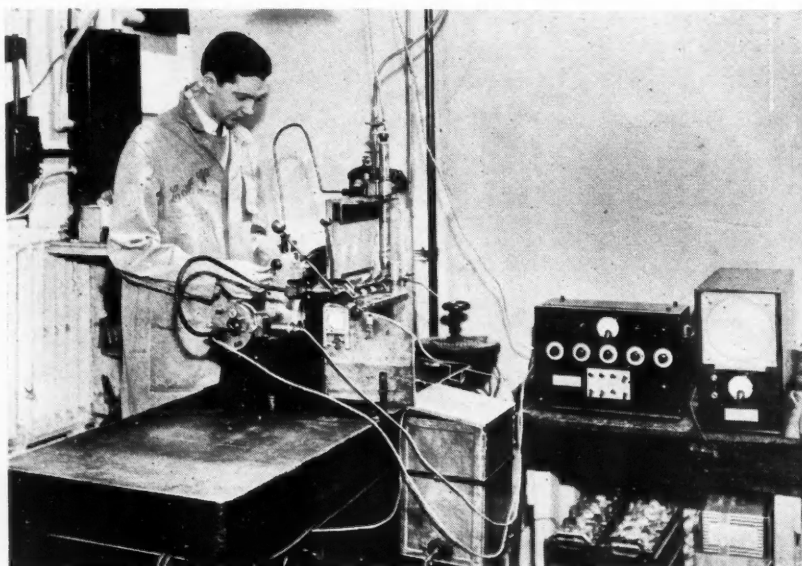
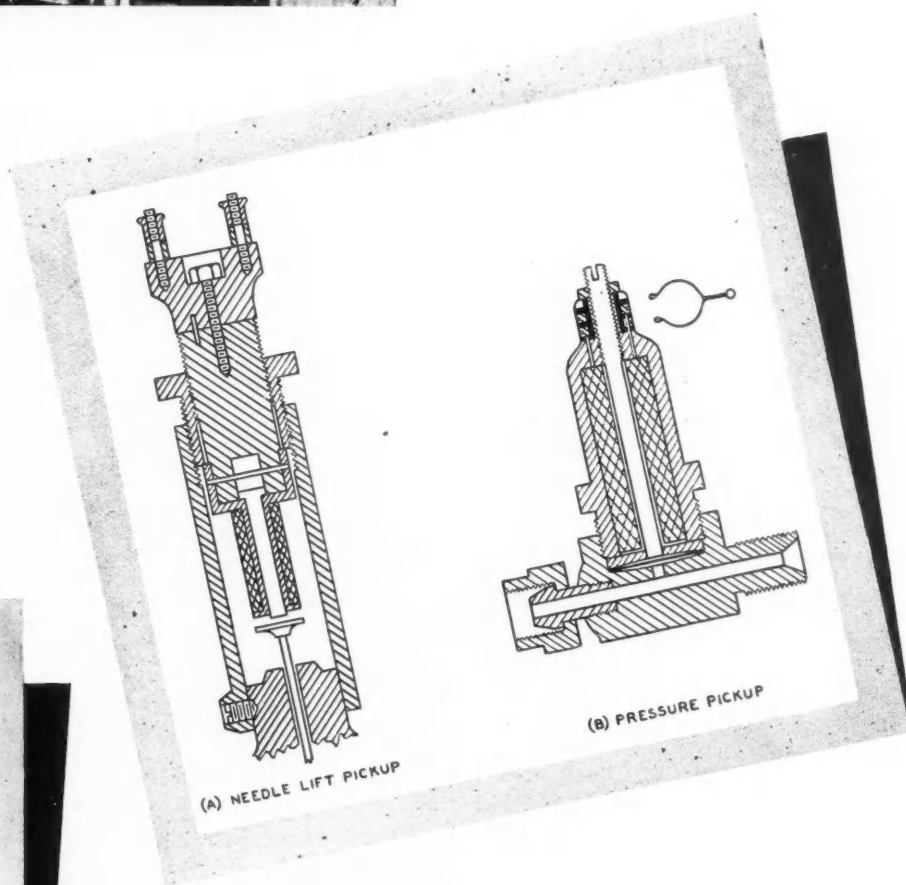
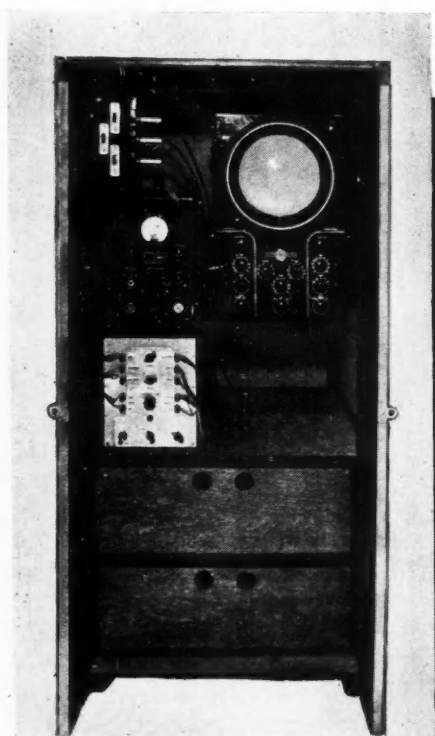


Fig. 6. (Above) Standard-Sunbury Cathode Ray Indicator and pump-test stand.

Fig. 7. (Right) Electromagnetic needle-lift pickup and line-pressure pickup.

Fig. 8. (Below) RCA-Penn-State Cathode-Ray Indicator.



substitute for the former. Timing and duration of the spray can also be determined by means of the stroboscope, but it is a more laborious method.

It is a rare case, indeed, when the simple tests mentioned, together with needle-lift diagrams, are insufficient for the evaluation of an injection system. The next thing to do is to take line-pressure diagrams with the oscillograph. These are taken either near the pump or near

the nozzle. Such line-pressure diagrams are shown in Fig. 5. Occasionally we go still farther and take pump-delivery-valve diagrams, an example of which is also shown in Fig. 5.

The Sunbury cathode-ray indicator, Fig. 6, utilizes electromagnetic pickups which make it particularly suitable for injection testing. The pickup shown in Fig. 7 consists of a permanent magnet with a winding around it. It is mounted close to the protruding end of the needle, which latter frequently has a small disk fastened to it. The motion generates voltages in the coil, which is registered on the cathode-ray screen. The voltage generated is proportional to the velocity of needle travel; therefore, it is electrically integrated in the instrument to obtain a regular needle-



Fig. 9 (Left)
Square wave



Fig. 10 (Above)
Square wave integrated.

Fig. 12. (Below)
Same as Fig. 11
without degree
scale.

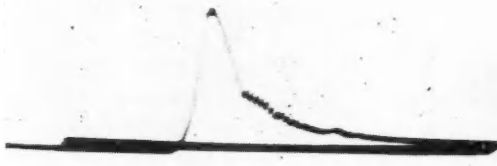


Fig. 11. (Center)
Dashed needle-lift
diagram. The
dashes are 2 deg.
apart.



lift diagram. This instrument was described in detail by Beale and Stansfield in *The Engineer* of February 26 and March 5, 1937.

The RCA cathode-ray indicator is designed to operate with piezo-electric crystals and is suitable for recording pressures, but not for recording needle displacements. If it is to be used for the latter purpose, it must be suitably modified. Fig. 8 shows the modified instrument.

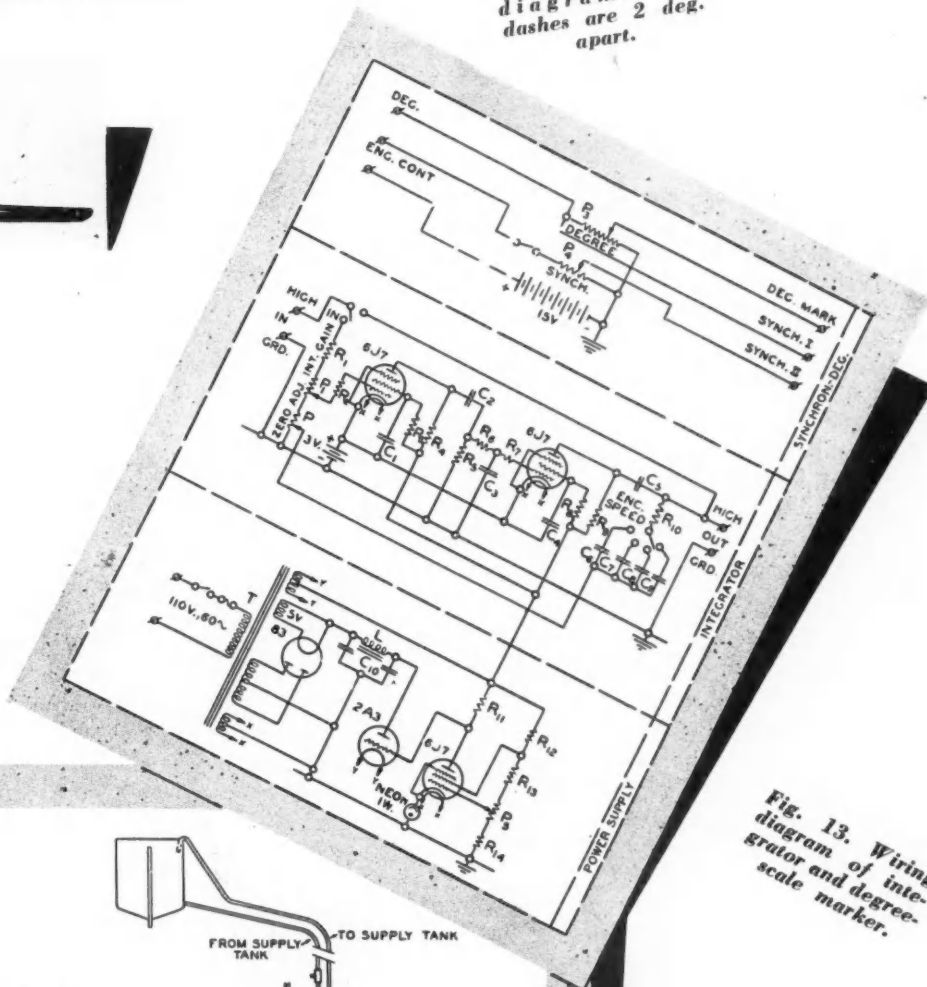


Fig. 13. Wiring
diagram of inte-
grator and degree-
scale marker.

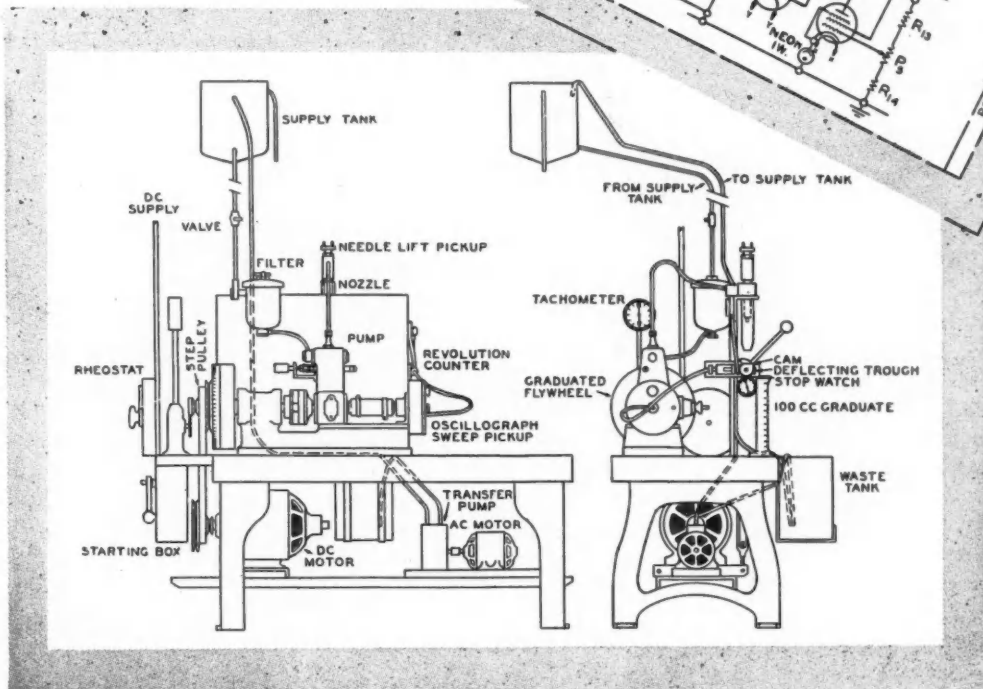


Fig. 14. Pump-test
stand.

To make it possible to use electro-magnetic pick-ups with this instrument, F. Veith, graduate assistant, has built an electrical integrator. To insure accuracy, the integrated voltage must be negligible, compared with the input voltage. In order to meet this requirement without inordinately reducing the sensitivity of the integrating circuit, a feed-back circuit is employed which corrects for the voltage on the integrating condenser.

A simple and reliable method of testing the integrating circuit and the effectiveness of the correction adjustment involves the use of a square wave, such as that shown in Fig. 9. Integration of this wave should give a trapezoid diagram, and the correct integration is easily recognized by the absence of distortion (see Fig. 10).

Combined with the electrical integrator is a degree-scale marker. The oscillograph trace consists of a dashed line, the dashes being 2 deg. apart. Fig. 11 shows a needle-lift diagram with dashes. This gives a very accurate horizontal scale. Every tenth degree is shown by a brighter dash and every 90th degree (including top center) still brighter. Fig. 12 shows the same needle-lift diagram without the degree scale.

The control element for the degree scale is identical with that of the Sunbury indicator, but the modula-

tion is impressed on the blanking amplifier of the RCA unit. Fig. 13 shows the wiring diagram of our integrator and degree marker.

A word should be added on the calibration of the cathode-ray oscillograph, although that phase is frequently over-emphasized. In most cases all the necessary information can be obtained without having an accurate vertical scale for the oscillograms. The latter, however, is not very hard to get. In calibrating cylinder-pressure oscillograms, the method described in *AUTOMOTIVE INDUSTRIES* of May 15, 1939, is used, and is similar to that of Beale and Stansfield. In calibrating injection line pressures near the nozzle, the pump speed is reduced until a distinct hump appears on the line-pressure oscillogram at the moment of needle-valve opening. The height of that hump is equal to the valve opening pressure, which can be determined by means of pressure-gage nozzle tester. This gives one reference point. It does not lead to any serious error if a linear relation between pressure and cathode-ray deflection is assumed. To calibrate needle-lift oscillograms we mount a dial indicator on the feeler pin of the injection nozzle and then determine the maximum needle lift by the cut-and-try method.

Fig. 14 shows a pump test stand at The Pennsylvania State College.

Automatic Welding Aids Clutch Production

PRODUCTION of a new design on a large scale often depends upon the development of new techniques in manufacturing, an example of which is the fluid clutch now used in some automobiles. Actual production of the Borg & Beck fluid coupling, which was described in the July 1 and October 15, 1941 issues of *AUTOMOTIVE INDUSTRIES*, was made possible through the application of such modern tools as the automatic arc welder.

Engineers for the Borg & Beck Co., Chicago, found that it was absolutely essential that there be no leaks at any spot in the coupling. They solved the problem by installing an "Electronic Tornado" automatic carbon arc welding head supplied by The Lincoln Electric Co., of Cleveland, Ohio.

A forging, which forms the axle of the coupling, must be welded at its outer and inner diameters to a shell and then the outer diameter of the shell must be welded by the automatic electric arc. A shell and forging assembly are shown in Fig. 1 set up for automatic welding of the inner diameter. The assembly, it will be noted, is mounted on a turntable which revolves it slowly under the carbon electrode as the welding progresses. String flux is fed through the upper of the two curved tubes to the left of the electrode and

(Turn to page 74, please)

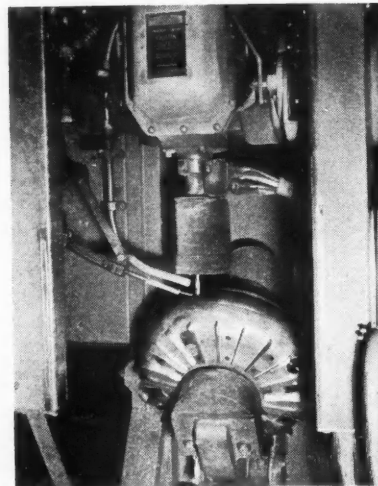
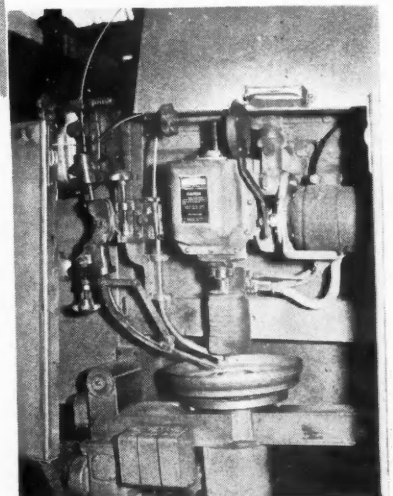


Fig. 1
Automatic arc welding of the forging to the shell of this fluid clutch part is about to begin. The tubes at the left of the carbon electrode are used to feed in flux and filler wire.

Fig. 2
The carbon electrode is about to "strike the arc" on the outer diameter of this clutch assembly, after which the clutch part will begin to revolve at a timed rate to complete the welding job.



WHAT THE INDUSTRY IS DOING

[Our own view of automotive production and sales;
authoritative interpretation of general conditions]

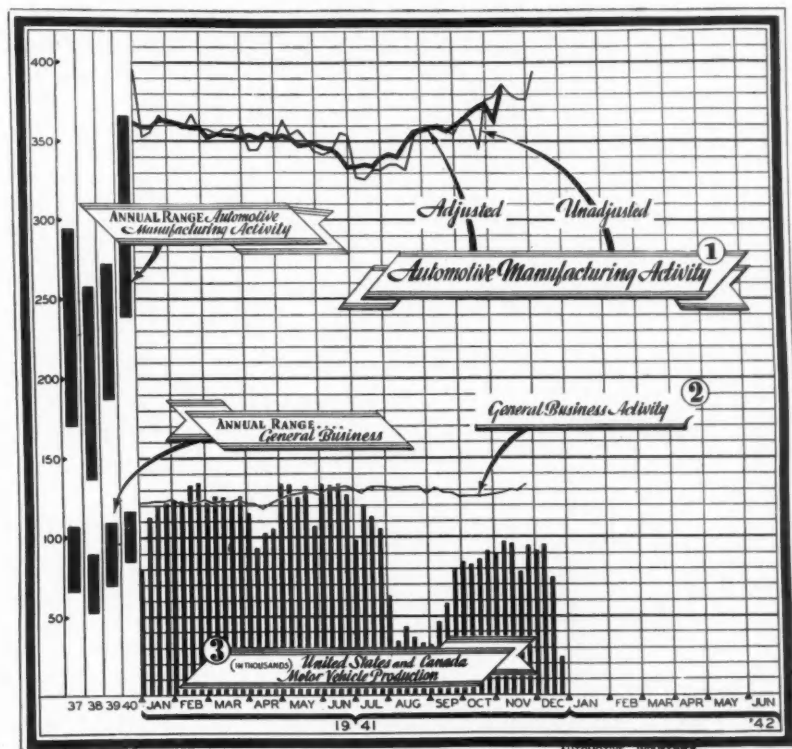
OUTPUT in the automobile industry during 1941 was the second greatest in the industry's history despite curtailment of passenger car and light truck production during the last five months of the year. The year saw production of an estimated 5,100,000 motor cars and trucks in the U. S. and Canada, marking a 9 per cent gain over the previous year. The record year still is 1929 with its total of 5,621,715 units, but the 1941 total slightly surpasses 1937, when 5,016,437 vehicles were manufactured.

December production was approximately 292,000 units, a decline of 42 per cent from the same month of 1940. Outbreak of war with the Axis powers early in the month compelled a downward revision of December quotas, with the passenger car total cut from 204,848 units to 153,636. The latter marks a 61 per cent decrease from December, 1940. January's revised passenger car quota of 102,424 vehicles is 75½ per cent below January, 1941.

During the week ending Dec. 20, the industry produced an estimated 74,500 vehicles, the lowest for any week since mid-September and a drop of more than 15,000 units from the previous week. This was because the companies concentrated their December production in the first half of the month in anticipation of a shutdown over the Christmas holidays. When the more drastic curtailment was invoked after the Japanese attack on Pearl Harbor on Dec. 7, the companies had to revise their schedules downward, leaving little output for the last half of the month.

GM divisions turned out 26,100 units in the week ending Dec. 20, with Chevrolet and Buick working five days and Pontiac three. Olds and Cadillac closed

¹ 1923 average = 100; ² Prepared by the New York Times weekly business index; ³ Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.



Weekly Indexes of Automotive General Business

1941 Second Greatest Production Year

Packard, Hudson, and Nash.

The week ending December 27 was expected to see a further drop in production to approximately 24,000 units, the lowest for any week since August, 1940. Most of the passenger car makers suspended production until after the holidays, while Christmas cut the work week to three days in most plants still operating.

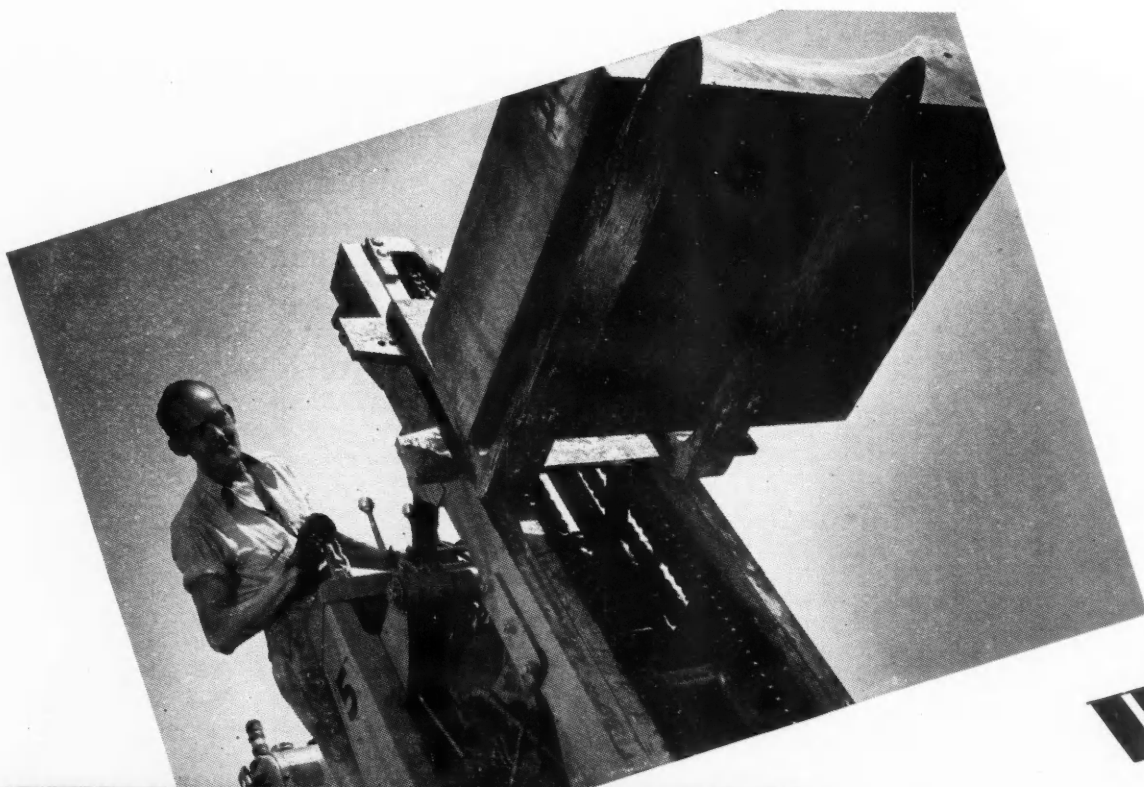
OPM is permitting manufacturers to combine their December and January quotas for scheduling the production any time during the two-month period. Tentative February quotas have been revoked and the government policy on passenger car and light truck output after February 1 is expected to be clarified by OPM at a meeting of the passenger car producers on January 14-15 or before.

Some sources believe that passenger car output may be suspended entirely for a few months beginning February 1, so that the government may canvass the materials situation, especially as it applies to rubber, tin, copper and steel. If the Far East shipping lanes are kept open for rubber shipments and if steel supplies are adequate, this proposed ban might be relaxed. However, others believe that some passenger car output will be maintained due to the necessity of keeping transportation facilities at peak efficiency.

Dec. 12 until after the holidays. All GM passenger car divisions were closed down after Dec. 19 and expect to resume Jan. 5. This period also permits the changeover to models without brightwork, the ban on chrome going into effect Jan. 1.

Chrysler divisions except Dodge truck worked only three days in the week ending Dec. 20, assembling 11,700 units. Ford operating on a five-day basis accounted for 20,900 vehicles.

Studebaker led the independents, followed by Willys,



West



KEEP 'em flying! That's the slogan in the West Coast airplane industry. We gave you a bird's-eye view of the activity in an introductory article in *AUTOMOTIVE INDUSTRIES*, Dec. 15, 1941, stressing outstanding mass-production techniques that have been adopted to maintain a steady stream of fighters and bombers and trainers on the air lanes to Canada, to Britain, to Russia—to the U. S. Army and Navy.

(Top) Designed to facilitate the lifting and hauling of heavy parts and materials, this Yale & Towne Cam-O-Tractor, powered by a Ready Power unit, weighs 9000 pounds, can lift a load of three tons, has a lift of almost ten feet above floor level. Shown here, it's lifting a heavy zinc die on the die lot, preparatory to setting it into a drop hammer at the Vega plant.

(Center) Night scene! A few of the 20,000 Lockheed and Vega night shift workers swarming about a P-38. Much of the final assembly work is done out in the open—day and night.

(Bottom) Looking down on the main assembly floor in the Lockheed plant. Here is a line of the famous P-38 Lightning Interceptors in various stages of completion.

THIS is the second of a series by the engineering editor of **AUTOMOTIVE INDUSTRIES**. The first instalment appeared in the issue of December 15 and gave an overall account of the changes that have taken place in the industry. In this article the author takes one behind the scenes in three of the outstanding airplane plants.

Coast Airplane Plants

The high ideals of quality—so vital to ships that fly—are best expressed in Major Fleet's watchword at Consolidated "Nothing short of right is right." You will find this message in every part of the plant, starting with the main lobby entrance.

Having in mind the overall picture, it is our intention now to take a closer look at four of the plants and to provide some perspective of each one. A similar study will be made of the remaining plants in a subsequent issue. The establishments to be considered now are—Lockheed, Vega, North American, Vultee.

Lockheed—Vega

Some conception of the extent to which the airplane industry has expanded almost overnight may be gained from the fact that in July, 1940, the combined productive floor space of Lockheed and Vega was 838,000 sq. ft., whereas by September, 1941, with the dedication of the new \$8,000,000 Vega plant, the combined facilities rose to a total of 3,151,938 sq. ft. Nor does this tell the whole story. Actually almost as much space again is being used for out-of-doors final assembly operations.

Since the acquisition of the Union Air Terminal late in 1940, Lockheed holds about 500 land acres, making it possible for them to take advantage of favorable climatic conditions conducive to work under the skies both day and night for most of the year.

It may be noted that the new Vega plant was described rather comprehensively in **AUTOMOTIVE INDUSTRIES**, Nov. 15, 1941, so that nothing further need be added at writing. We might mention for the record that in the interim the actual outlay for this plant has been written up to \$8,000,000 (published estimate was \$7,000,000).

These airplane plants are so extensive in their operations that for our purposes we shall rely primarily upon the visual evidence of photographs rather than upon a word picture.

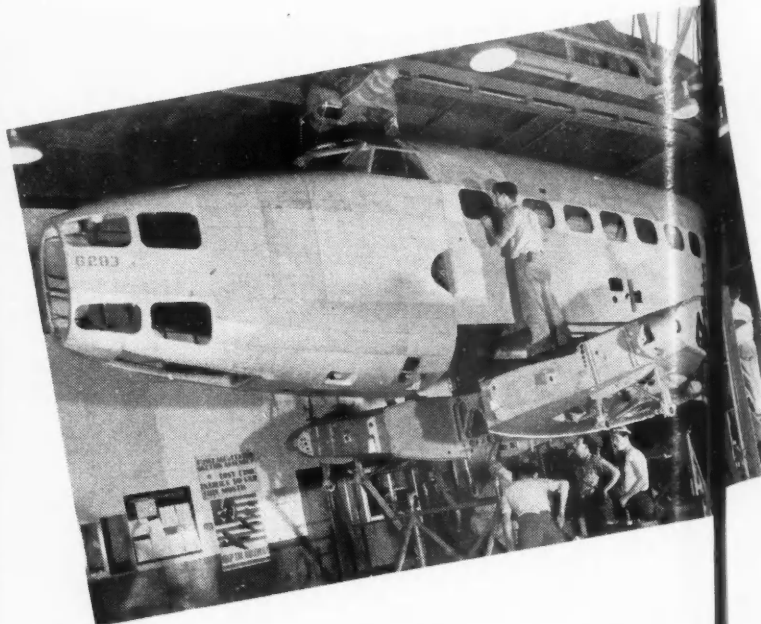
Suffice it to say that the main floor plan has been developed along scientific lines to facilitate the smooth flow of materials from the preliminary operations to sub-assemblies to final assembly. Here will be found a huge press shop for the fabrication of sheet metal parts of every variety. Among the noteworthy items of equipment in this department are big Clearing all-steel presses, Cincinnati press brakes of various sizes, a huge Watson-Stillman press of 4500-ton capacity served by a nest of work tables, a 2500-ton Farrel press for large parts formed with rubber dies. This department is served by a tool and die shop and an extensive foundry and pattern shop for the making of Kirksite zinc dies for drop hammer operations. The foundry melts 10 tons of metal per day for this purpose.

One of the major fabrication departments is the welding shop, specializing in torch welding and resistance welding in accordance with the latest practice. Large batteries of Sciaky controlled cycle resistance welders and some new Federal seam welders will be found here.

Paint shop facilities are the most modern to be found anywhere what with the use of water-back spray booths ranging from small one-man affairs for small parts to equipment large enough to house the largest airplane produced by the company. Among the special features in this connection are—monorail dip conveyor dip painting, and the DeVilbiss table conveyor for spray painting small parts and drying them under a canopy of powerful infra-red baking lamps. On this conveyor the parts are dried in 20 sec., permitting them to handle upwards of 150,000 small pieces of assorted sizes per day.

Following modern practice, precision sub-assemblies such as wiring harness, instrument clusters, hydraulic lines, electrical control panels, etc., are separated from the main floor operations and are handled on a mezzanine gallery. The finished units are delivered to the final assembly stations at points of use.

Quality takes precedence over every other consideration, is safeguarded by a large corps of trained and picked inspectors. In the manufacturing operations, inspection is segregated into 10 divisions: Receiving, machined parts, welding, sheet metal fabrication, sheet



(Above) Quite like a body drop. Here is the fuselage of a Lockheed Hudson bomber being lowered onto its center section in the mating jig.



(Above left) One of the big Clearing hydraulic presses, this one with a rotary table to speed up the loading of small parts. Scene taken at Lockheed.

(Center left) Loading and unloading ends of DeVilbiss paint spray conveyors at Lockheed. Foreground—loading the small parts on the conveyor. Background — removing parts after they have been sprayed and baked under a canopy of powerful infra-red lamps. Baking time is only 20 seconds.



(Lower left) One of a large battery of Sciaky resistance welders at Lockheed. This is a seam welder used on a variety of formed sections.

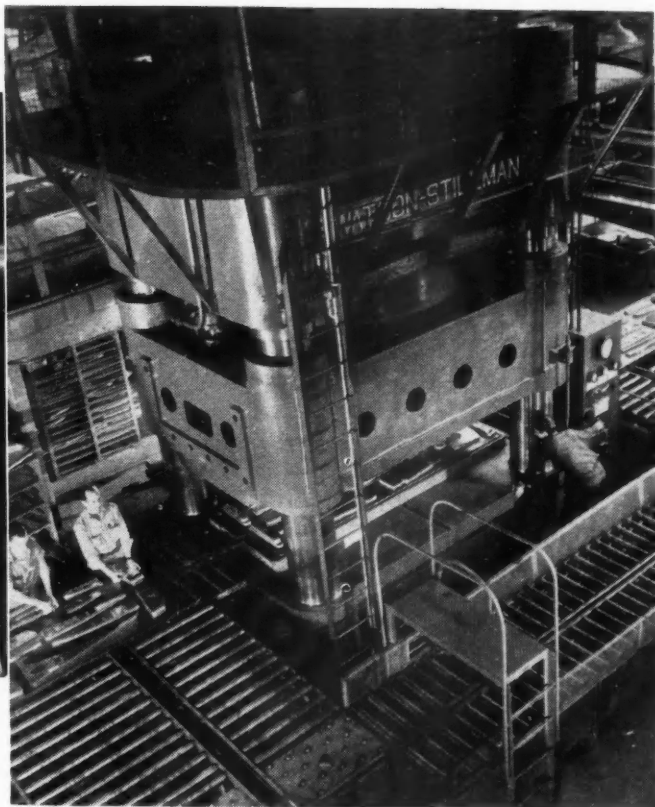
metal sub-assembly and spot welding, precision sub-assembly, wing and tail unit assembly; fuselage and center section assembly, final assembly, and flight. In-line and sequence inspection procedure is followed to insure a steady flow of materials to the proper point at the proper time.

All parts and materials used in the manufacturing of an airplane are inspected by the receiving divisions. Castings and forgings are subjected to X-ray examination, and steel forgings to magnetic tests. Materials that do not come up to factory and U. S. Army Air Corps standards are rejected.

Machined parts are checked for accuracy of machining and quality of workmanship. Welding is sub-



Several of the Kearney & Trecker milling machines found in the tool room and machine shops at Lockheed.



(Above) Lockheed boasts this 4500-ton Watson-Stillman press. Small sheet metal blanks are loaded on block dies, carried onto the press bed by means of a four-way roller platform.

jected to visual inspection and then Magnafluxed.

In precision sub-assembly all instruments and hydraulic equipment are tested for workability and accuracy.

The flight inspectors certify planes for flight tests. No plane can leave the ground until it has their okay. They go over the plane from wing tip to wing tip, nose to tail; every control is tested, and reactions of workable parts studied.

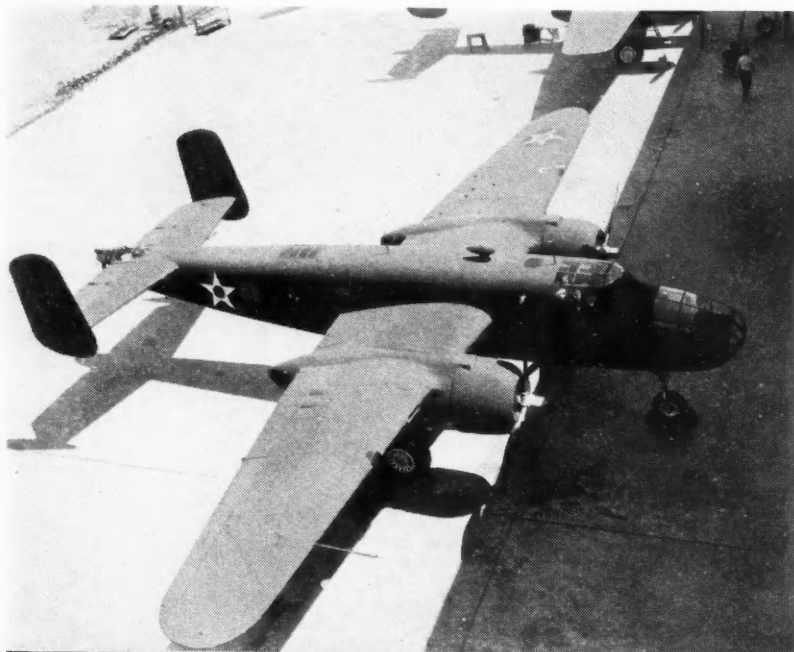
A new aid to speedier mass production of aircraft—an electrolytic transfer process by which work templates can be reproduced in five minutes—has been developed by Lockheed laboratories, and is being made available to the industry. This process, like the photo-loft-template process, eliminates the tedious, time-consuming hand reproduction of duplicate work copies, saving weeks and thousands of dollars in the construction of new aircraft models, and making substantial savings wherever duplicate templates are needed.

In copying full size master templates, the electrolytic transfer process is said to be faster and more economical than the recently developed photo-loft-template process. The latter method of producing template work copies, however, has the advantage of being able to reproduce a master layout in any scale, whereas the electrolytic transfer process is limited to actual size reproductions.

There are only three steps in making work templates by the electrolytic process: the preparation of the original drawing by an engineer; the scribing of the drawing on a specially treated metal sheet to make the master layout; and the

(Below) Close-up of the cemented-carbide-tipped milling cutter used on the Onsrud extrusion miller at Lockheed. These cutters give upwards of 300 per cent longer life, better finish, and less down time. Soluble oil is used to cool the cutter and work and to wash away the chips.

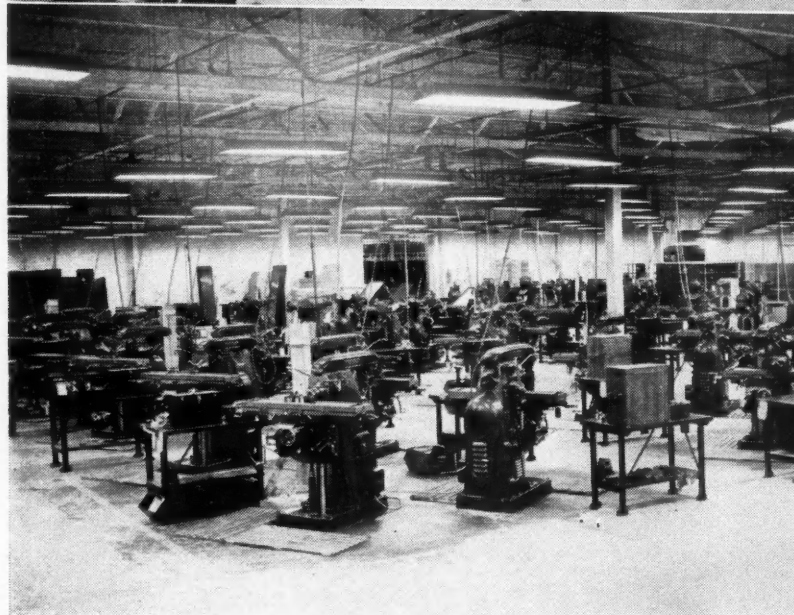
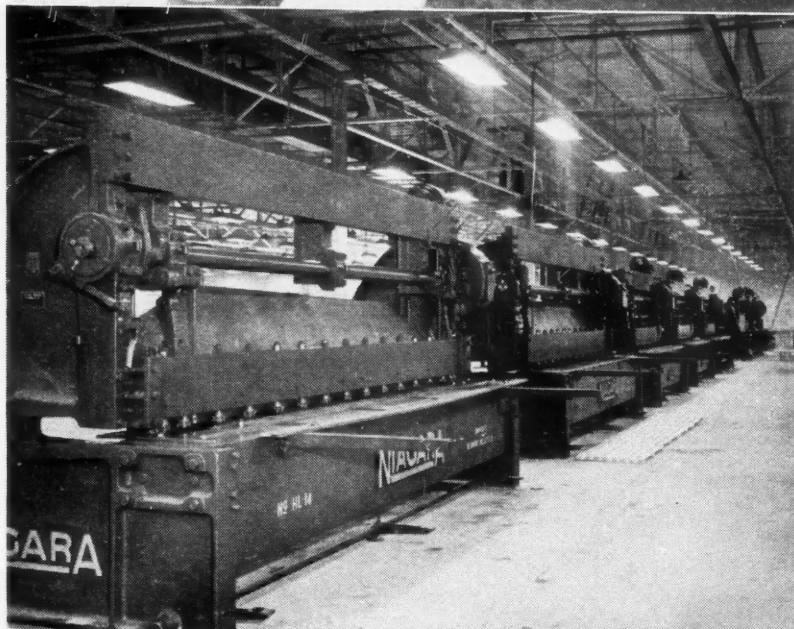




(Top) North American flight ramp and outdoor assembly areas with a B-25 bomber in the foreground ready for its flight crew.

(Center left) Some idea of the extent of sheet metal preparation involved in the North American plant in Dallas may be gained from this imposing row of Niagara power brakes.

(Bottom left) One of the best-equipped machine shops in the industry is found in the North American plant in Dallas. Here is a corner devoted to milling machines with familiar Cincinnati millers of various types dominating the foreground.

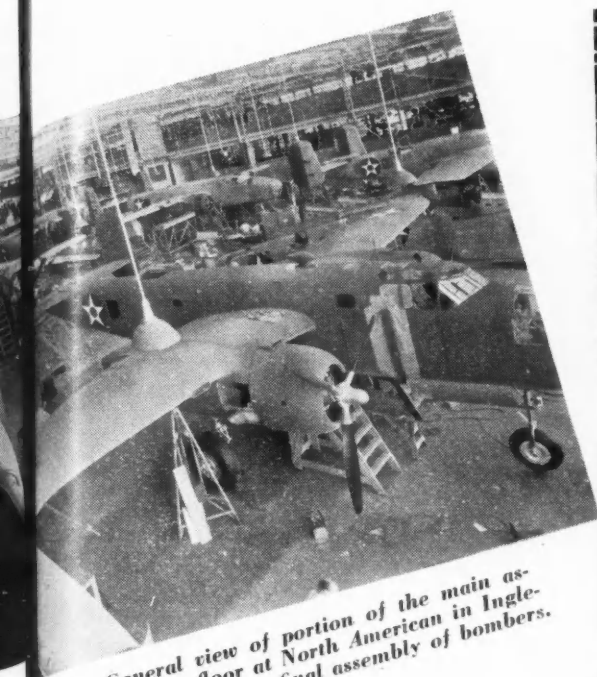


transfer of the scribed layout (with all the detailed information noted on it) to an inexpensive metal copy sheet from which the work template will be cut.

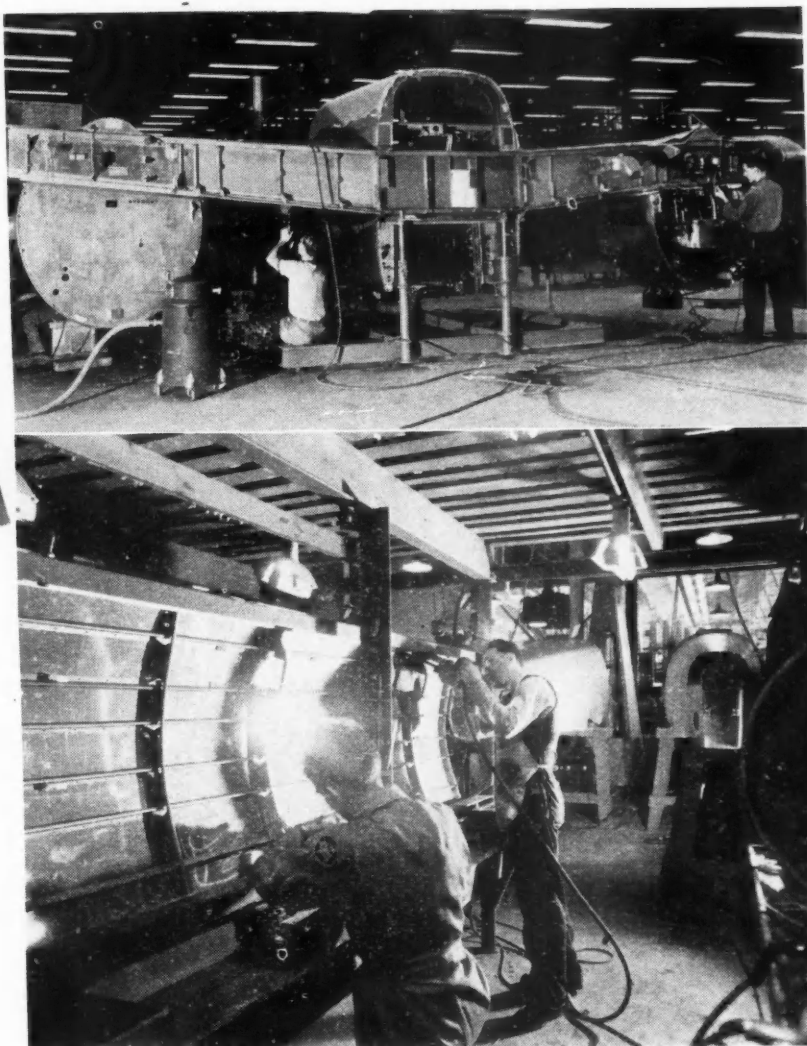
Another advance registered by Lockheed is the introduction of the Onsrud high-cycle extrusion milling method which effects a saving of three and a half days per plane in milling the 10 extrusion used in a P-38 Interceptor. This extrusion miller is 30 ft. in over-all length, with a cutting area 12 in. wide and 20 ft. in length. The carriage travels on ways by means of rack and pinion, giving a feed range of 3 ft. to 18 ft. a min. in either direction.

A platform is fastened on the back of this carriage, on which the operator stands about 15 in. off the floor, riding the carriage as it shuttles back and forth the full length of the extrusion on the mill. Two helpers on the floor meanwhile feed the extrusions into the machine and keep the chips cleared away. Control panel for motors and air cylinder controls are mounted on the platform.

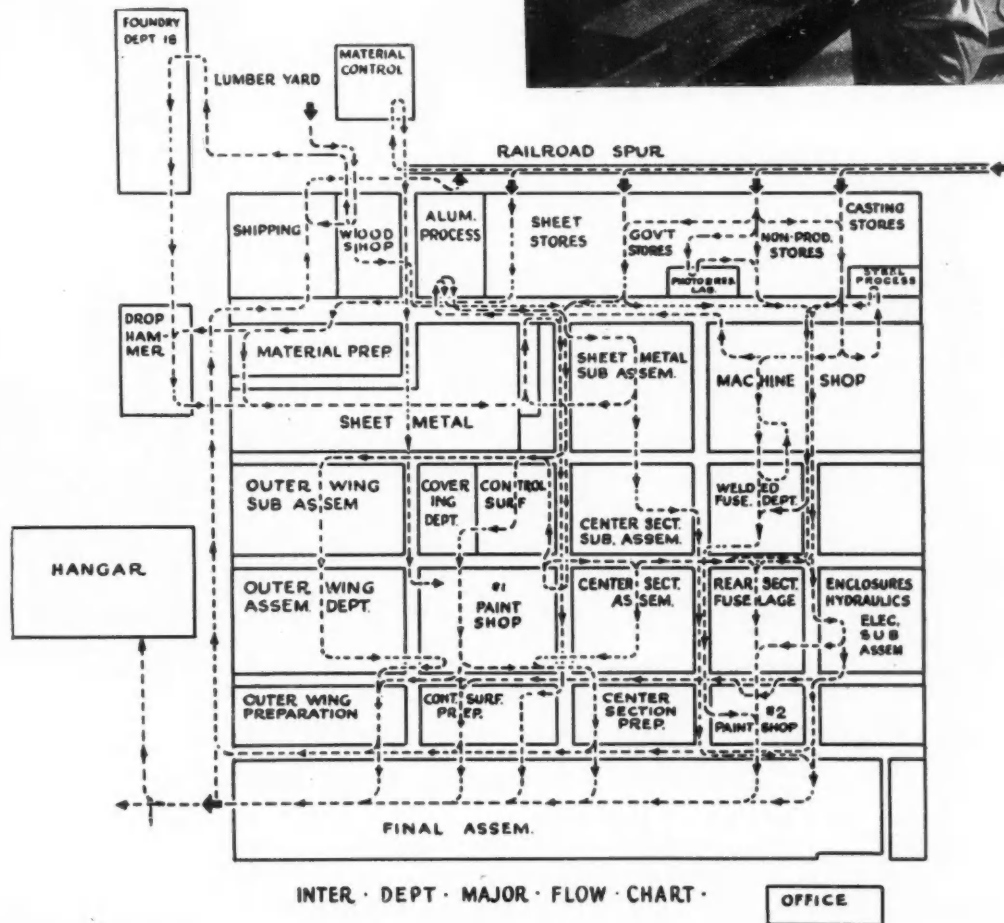
Perhaps one of the most impressive features here is the operation of the X-ray department of the Triplett & Barton Laboratories, equipped with four fully automatic X-ray machines capable of



General view of portion of the main assembly floor at North American in Inglewood showing final assembly of bombers.

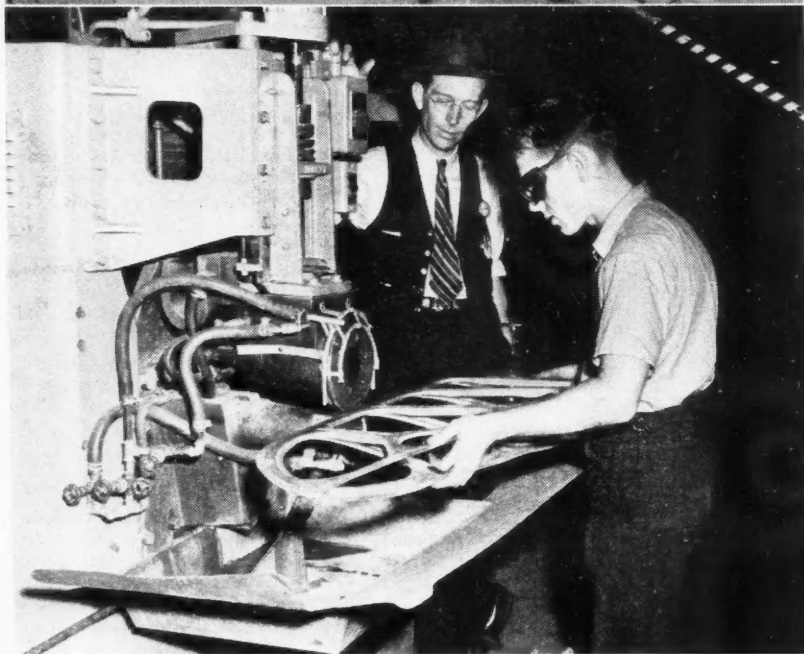
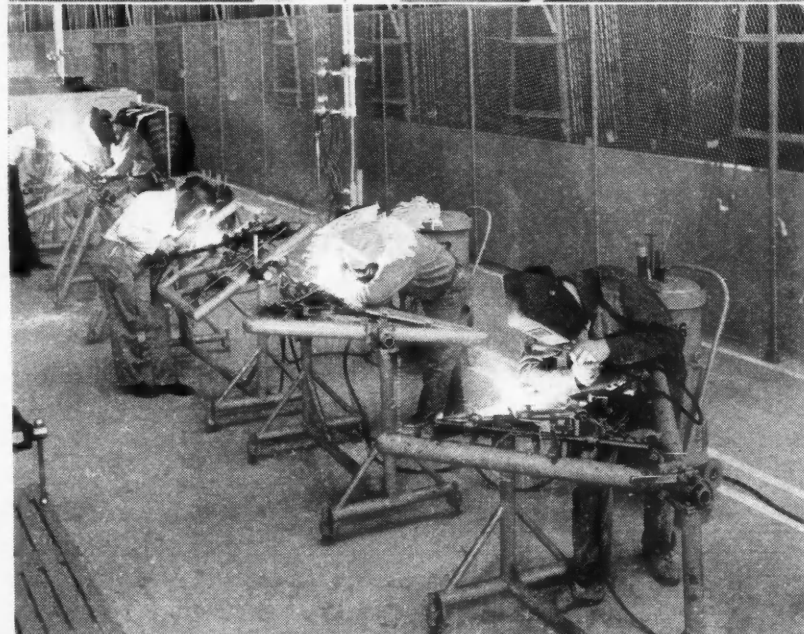
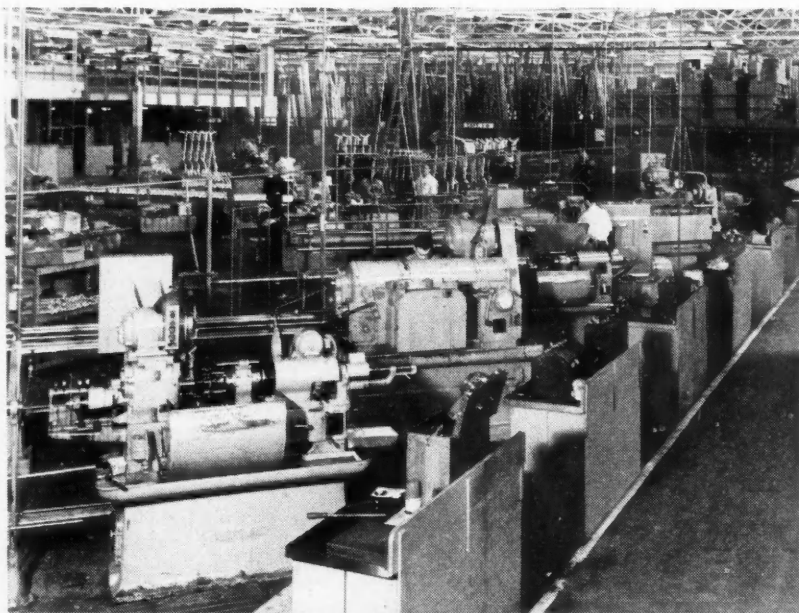


(Top) Backbone of the NAA B-25 bomber is the center section shown here. This is how the center section appears in the early stages of assembly.



(Above) Men at work! Riveters assemble a side panel for the B-25 bomber at the Inglewood plant of NAA.

(Left) Schematic floor plan of the NAA plant in Dallas, showing the flow of parts and materials through fabrication departments and finally to final assembly.



completely radiographing about 20,000 aluminum castings per day. That's science on a mass production basis.

The automatic machines are used principally on light alloy parts. In the interest of speed, smaller castings and forgings are sent to these machines, and the odd sizes to the regular X-ray rooms, which also handle bronze, steel parts, weldings, and material too large to be placed conveniently under the hood of an automatic machine.

These machines are operated by a robot control. When the X-ray control is turned on, the cabinet is lowered in place and held there until the exposure has been made. It is then raised automatically and the conveyor table, which is synchronized with the X-ray mechanism, slides out from under the hood. Then a new set-up of parts is pulled into place and radiographed. This continuous opera-

(Left top) Perspective of the large screw machine department at Vultee. It includes many familiar pieces of equipment. In the foreground may be seen a small Conomatic and a single-spindle Cleveland automatic.

(Center left) Corner of the welding department at Vultee, showing arc-welding operations, employed exclusively for the joining of tubular members.

(Bottom left) Seam welding operation is improved, life of tools extended at Vultee, by the introduction of water-cooling of each roll. The improvised cooling arrangement may be seen in this view.



tion makes it possible to expose a negative a minute.

A new 440,000-volt machine, 6 feet long, 30 inches wide, and about 50 inches high, has recently been installed in one of the lead-lined rooms to radiograph heavy castings and tools.

In view of the rapidity with which castings can now be examined for imperfections, their use is being increased in the newer type airplanes. Based on the success they have had with the X-ray inspection of aluminum castings, Lockheed and Vega engineers are said to be designing all the newer models to take a higher percentage of castings.

North American

Biggest news from NAA headquarters in Inglewood is the inauguration of an extensive policy of sub-contracting in which fully 30 per cent of its manufacturing and assembly job is farmed out. It is estimated that in 1942 the purchases of outside labor, parts and materials will have reached a total of \$100,000,000.

Even more impressive was the announcement late in November that Fisher Body had begun delivery of bomber sections to Kansas City for assembly into NAA B-25 bombers. The program gives Fisher Body responsibility for producing assemblies for about 55 per cent of bombers, excluding engines and instruments. Each shipment of sections for a single bomber will have 18,000 parts and 107,000 rivets.

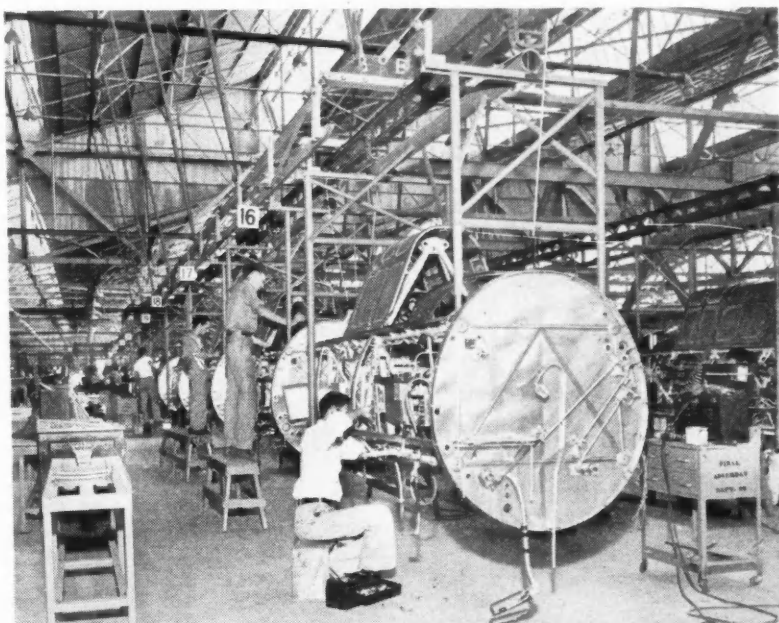
North American now has in operation three plants, the main plant in Inglewood, an assembly plant in Kansas City and the trainer manufacturing plant in Dallas, Texas. The floor space at Inglewood is around 1,100,000 sq. ft. at this writ-

ing. The southwest wing of the plant, added early in 1941, has a ground floor area of 107,250 sq. ft. and a mezzanine of 102,750 sq. ft. This wing houses the following activities:

Ground floor—sheet metal, 29,250 sq. ft.; bomber sub-assembly, 30,000 sq. ft.; tool, template and die crib, 6300 sq. ft.; material preparation, 27,000 sq. ft.; jig construction, expanded to 18,000 sq. ft.; second floor—new spot welding quarters, 4000 sq. ft.; tanks, ducts, and seats, 16,900 sq. ft.; central store room, serving departments 13, 27 and 21, 9000 sq. ft.; new quarters for sheet metal sub-assembly, 23,500 sq. ft.; and cowlings and fairing sub-assembly, 31,600 sq. ft. In addition, a separate structure to the south, separated from the wing by a court, expands the forms and foundry quarters to 12,000 sq. ft., and provides 9600 sq. ft. of space as new quarters for the wood shop.

The Inglewood plant embodies the most modern

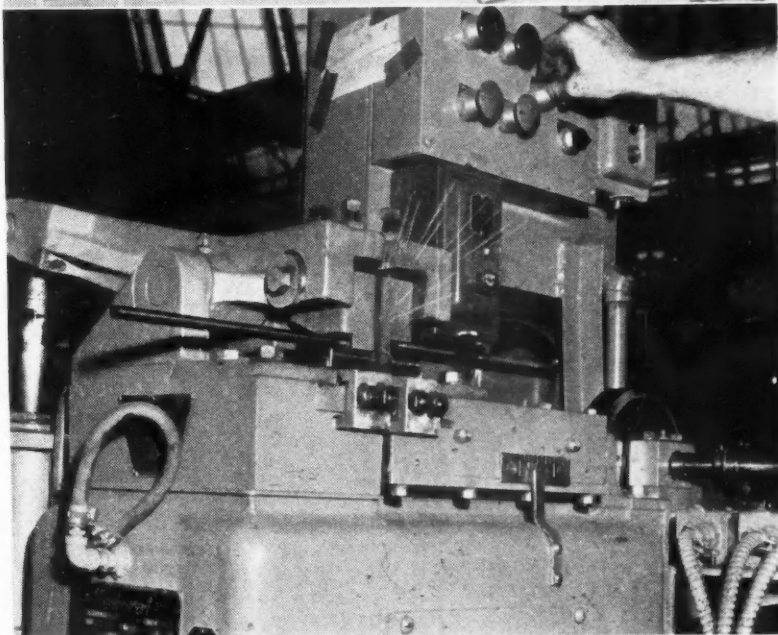
(Turn to page 76, please)

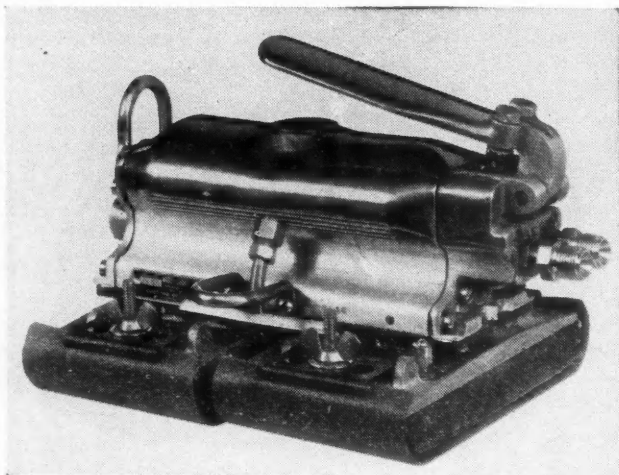


(Top right) A view along the mechanized assembly line at Vultee. It will be noted that the assembly fixtures are suspended from the overhead monorail.

(Center left) This is a view in Vultee's modernized press shop with a line-up of Minster presses.

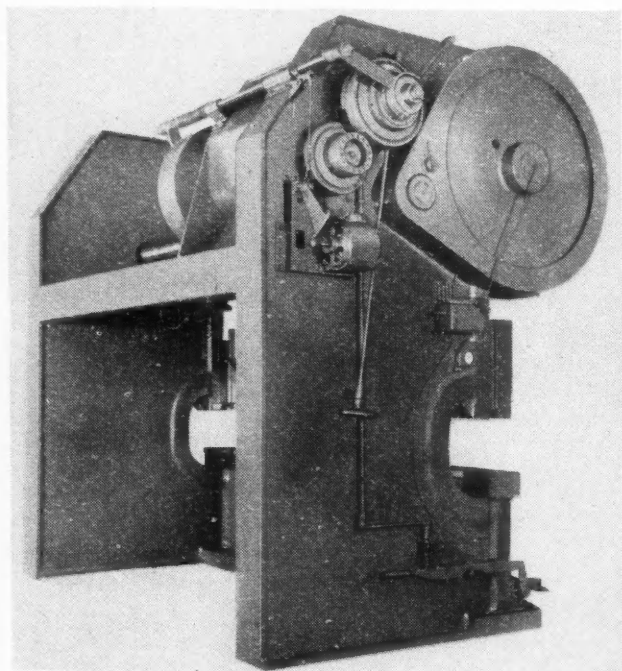
(Right bottom) Close-up of a Federal flash-welder being used experimentally at Vultee for welding fittings onto tubular members. This procedure is expected to mark an important advance over the older methods of joining.



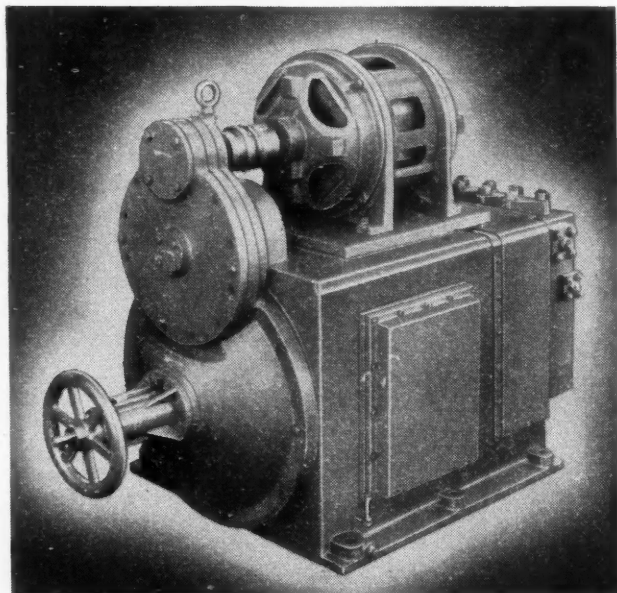


MEN and

This new Sundstrand pneumatic sander gives vibrationless performance; it is adaptable to many uses on wood and metal.



Designed to reduce operator fatigue, this new clutch and brake mechanism for bending presses is offered by Steelweld.



Built by the Watson-Stillman Co., Roselle, N. J., this new variable delivery, high-pressure pump permits stepless change from 0 to 6 gpm. at 5000 lbs. per sq. in.

A NEW speed nut ring for attachment of landing lights, hand hole plates, etc., is being manufactured by Tinnerman Products, Inc., Cleveland, Ohio. Designed with floating U-type speed nuts snapped over an aluminum carrying ring, this new unit weighs only 30 to 40 per cent of other type fasteners. This ring can be riveted to a doubler plate or other structures. The desired degree of "float" can be governed by the size of the hole over which the speed nuts fit.

GISHOLT MACHINE CO., Madison, Wis., has announced the development of two new tools for turret lathes. One, an end-facing and forming tool, is used for facing, forming, and chamfering the ends of shafts, studs, bolts, screws, etc. The second, a pointing tool similar in construction, provides a quick means of chamfering the ends of such work pieces for true starting on a single or multiple cutter turner. On each tool the rollers, which are mounted on needle bearings, are easily set for diameter. Substitution of a roller support assembly equipped with straight rather than bevel rollers converts the pointing tool into an end-facing and forming tool; both tools may be used for light turning by substituting the proper cutter. Ample cutter room is provided in each case.

THE Steelweld Machinery Division of The Cleveland Crane and Engineering Co., Wickliffe, Ohio, has developed an electrically-operated clutch and brake mechanism designed to be installed on Steelweld bending presses. By depressing a foot pedal the operator closes a switch connected in the circuit of a torque motor which operates either the clutch or the brake. If the clutch is engaged, the next depression of the pedal will cause the brake to be applied; when the brake is on, the next depression engages the clutch. A safety device prevents the machine from being started unintentionally. The brake is applied automatically if the power supply fails.

RELiance ELECTRIC AND ENGINEERING CO., Cleveland, Ohio, has developed a dust collector for wheels used in the rough grinding of castings. A blower driven by a 1-hp. motor draws the chips and grit from the wheel through a short length of hose into an ordinary waste can where a baffle breaks up the swirling motion of the waste material and causes it to be deposited in the

MACHINES

bottom of the can. A large bag attached to the can releases the pressure built up by the blower. Under ordinary conditions the can, which holds about 75 lbs., needs emptying about once a month.

THE W. F. and John Barnes Co., Rockford, Ill., offers Model 420 two-spindle horizontal drilling and boring machine which is especially useful in the drilling and boring operations on medium calibre guns. Since the work is revolved in deep hole drilling, the hollow tool holder is mounted permanently to the machine base. Chips carried away from the work through this hollow shank are filtered out of the coolant which is returned to the work area. Constant feed per revolution is assured since the spindles and hydraulic pumps are driven by the same motor. Model 420 will handle deep hole drilling up to $3\frac{1}{4}$ in. and cylinder boring up to 8 in. The standard model is supplied with a 20-hp. motor, gives rates of feed from $\frac{1}{4}$ to 9 in. per min., and spindle speeds from 62 to 814, or 25 to 329 rpm. Lengths of stroke from 4 to 12 feet are available.

THE Sundstrand Machine Tool Co., Rockford, Ill., announces its new improved Hi-Speed Pneumatic Portable Sander. This opposed pad type machine, which runs at approximately 3000 strokes per minute, is said to be vibrationless and less fatiguing to the operator. Various types of sandpaper attachments are available for a large range of work on metal and wood surfaces.

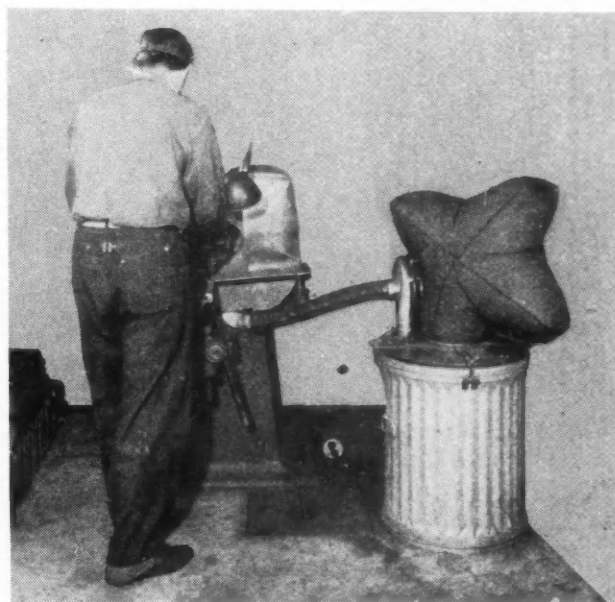
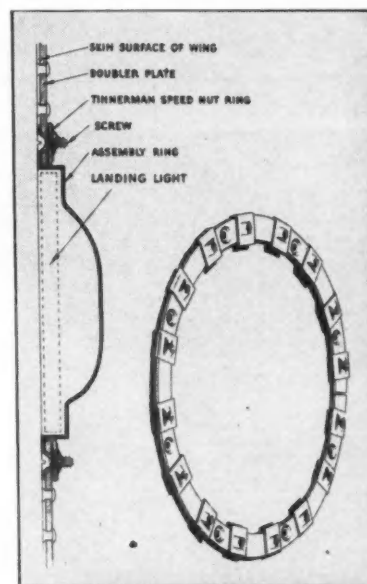
A NEW, variable delivery, high-pressure pump has been built by the Watson-Stillman Co., Roselle, N. J. It is a development of the company's line of "Stediflo" pumps, new in that the flow is infinitely variable from 0 to 6 gpm. at 5000 lbs. per sq. in. This is accomplished by a new driving member trunnioned on the drive shaft; its angle can be varied while the pump is running to produce a change in plunger stroke from 0 to 4 in. The stroke con-

trol shaft is extended to the outside of the pump casing for attachment either to a manual or automatic pressure control. The pump is especially suited to hydraulic press application; where a rapid advance must be followed by a slow movement at high pressure.

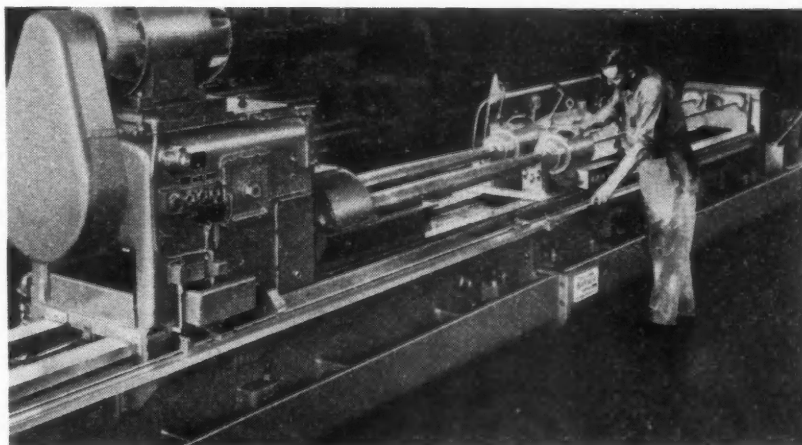
Equipped with a 25-hp. motor, this unit occupies a floor space of 4 ft. by 4 ft. The standard weight is 5000 lbs.

(Turn to page 64, please)

Tinnerman speed nut ring facilitates assembly and reduces weight.

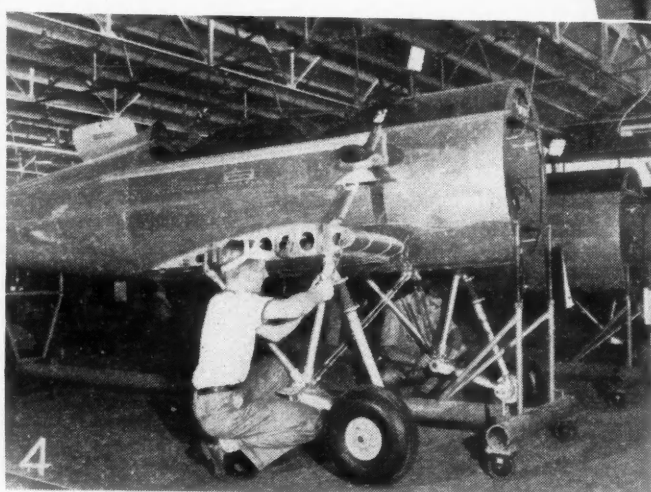
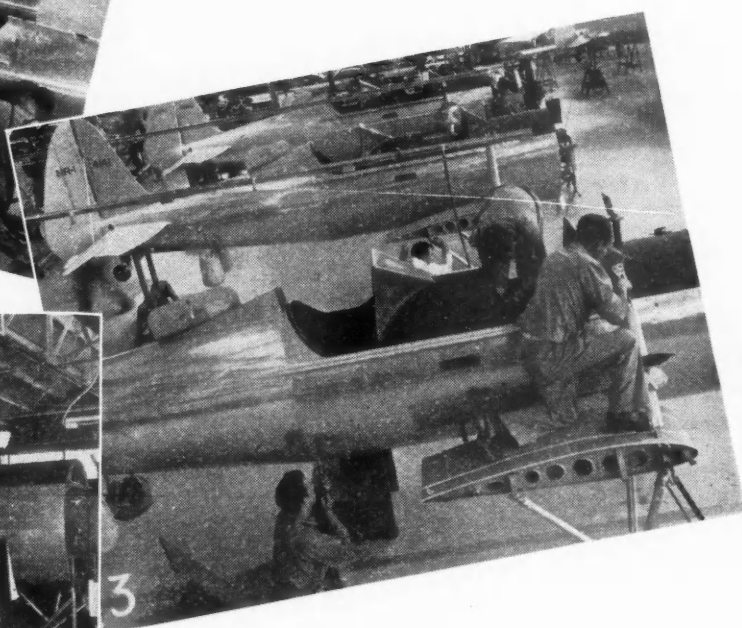
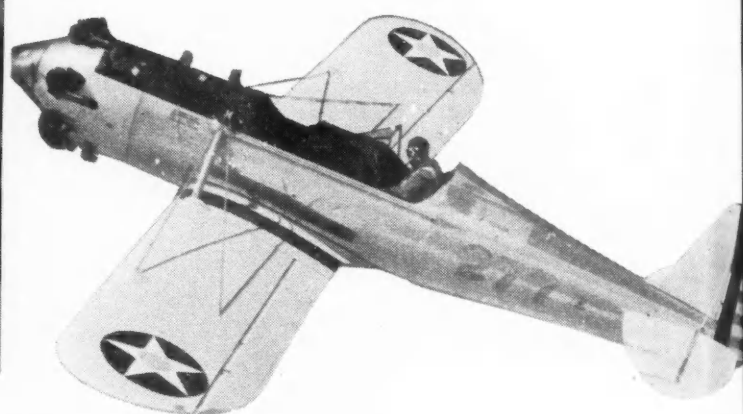
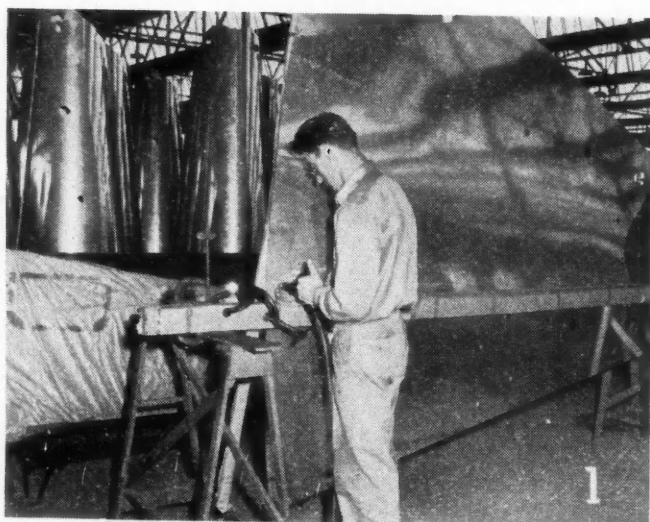


Reliance dust collector uses ordinary waste can for receiver.



Horizontal drilling and boring machine, Model 420, offered by W. F. and John Barnes Co., Rockford, Ill., provides efficient means for drilling and boring operations on medium calibre guns.

Production of Primary



Trainers at Ryan

HERE is a series of views showing the sequence of final assembly operations for the newest Ryan primary training model, known commercially as the Ryan ST-3. Hundreds of them are being built at the San Diego, Calif., plant of the Ryan Aeronautical Co. for the U. S. Army and Navy to be used for initial flight instruction of pilots. The Army's designation of this plane is PT-22, and the Navy calls its similar version the NR-1. Here is shown a PT-22, powered by a Kinner 160-hp. engine.

Equipped with flaps, brakes, trimming tabs, steerable tail wheel and other modern accessories, these low-wing trainers are the latest in a long line of Ryan S-T training models. Earlier Ryan trainers, the PT-16 and PT-20, were placed in service at the Army Air Corps training detachment, Ryan School of Aeronautics, where aviation cadets were the first in the 30-year history of the Air Corps to receive their primary training in monoplanes. Formerly, biplanes were the Army's standard training ships.

1. A future Ryan PT-22 trainer begins to assume its first recognizable shape with the riveting of flat pre-cut and pre-drilled aluminum alloy sheets to form the tail cone section of the fuselage.

2. To start the final assembly, tail cone and forward fuselage section are placed in a jig and the skin riveted together. Now the fuselage is ready to move in its jig down the production line.

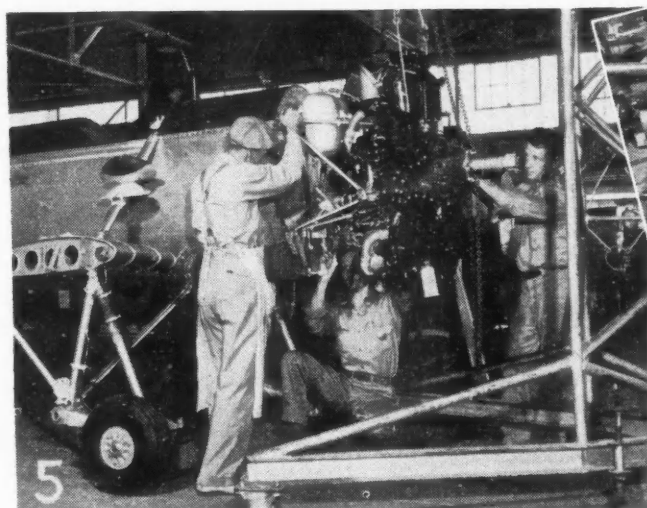
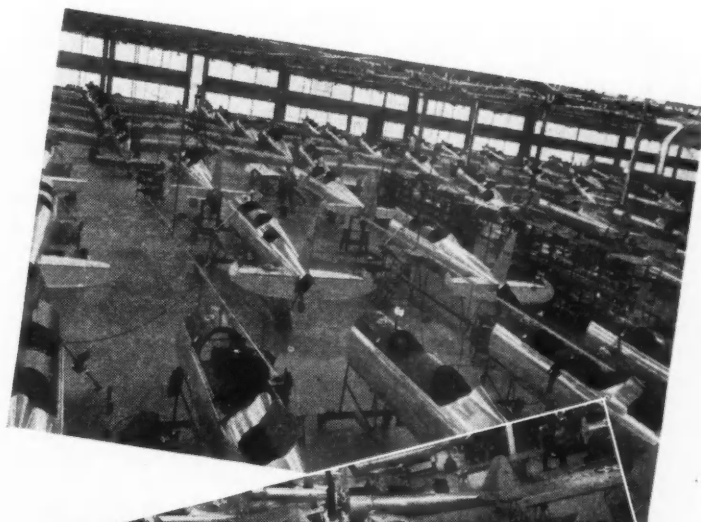
3. Then the fuselage receives its tail surfaces, tail wheel, stub wings, windshields and other units.

4. Landing gears next are attached as the plane moves down the line. Note how part of the landing gear load is carried by the stub wing strut and wires to main bulkhead.

5. A Kinner five-cylinder radial engine is swung into place and bolted to No. 1 bulkhead. All power plant accessories are assembled on the engine before it is mounted on the plane.

6. While the fuselage is making its way down the line, wing department workers and paint shop crew prepared the outer wing panels for attachment to the stub wings.

7. This over-all view of the Ryan production lines shows dozens of PT-21, NR-1 and PT-22 trainers on the final assembly floor nearing completion.



PRODUCTION LINES

Shot Blasting

Shot blasting—specifically to increase the fatigue resistance of highly stressed parts—has stood the test of time, deserves a place in engineering and manufacturing as a technique comparable to heat treating and to other basic processes. At the outset, shot blasting was employed as a sort of salvage procedure. More recently, in the case of the Chevrolet and Buick clutch springs, it became an essential process. The latest trick is the use of shot blasting to increase the factor of safety of Buick connecting rods in the change-over to ferrous pistons. By now we know that shot blasting really works. But many people would like to know why it works. To get an answer to this question, we went to one of the foremost experimenters in this field. Here is how he sums it up.

* * *

In the first place, it has been found that fatigue failure is induced more readily in a tension-stressed element than in compression. It is now believed by certain engineers that shot-blasting, when properly done, places the outer surface under a severe compression stress, something above the elastic limit of the material. This type of surface then resists fatigue failure under loads far in excess of normal. To prove that the surface thus treated is, indeed, in compression, thin mild steel test specimens have been held in a suitable fixture and restrained from movement. After shot blasting, this specimen is found to possess curvature, i. e., it attains a state of permanent set. It is obviously in compression. In fact both surfaces of the thin strip are in compression, with the inner surface in tension. This process is reversible. When the stressed skin is carefully removed by hand honing, the specimen returns to its normal flat state, save for a minute distortion due to the cold work in honing. It seems to us that this demonstration is quite ingenious and an excellent example of creative science at work. We recommend the technique to engineers and production men who are interested in promoting the art.

Milling Calculator

A neat, pocket-sized slide-rule type Calculator has been developed as a means for solving the numerical relationships encountered in milling machine set-ups. Among other things, the Calculator makes it possible to determine satisfactory speeds and feeds for a wide range of materials, for a wide range of performance requirements.

This handy tool for production men is a product of the research division of The Cincinnati Milling Machine Co. We don't know how many of these Calculators will be available for distribution but we shall be glad to pass your request on to Cincinnati.

For Defense

Young Radiator Co., recently made up a brochure which could well be emulated by many parts makers of our industry. Entitled—"Plant Facilities for Defense Production"—its importance and significance at this time reside in the fact that Young provides practically a complete inventory of its production equipment. This makes it a simple matter for anyone who wants a lift on a defense contract to decide whether Young has the facilities. Obviously this type of report is just made to order for the many organizations who are seeking sub-contractors; and of tangible value to OPM in its analysis of industrial organizations. Naturally we are pleased to find that our article, "Versatility Marks Young's Production," reprinted from AI, May 1, 1939, outlining the manufacturing activities of this company has been bound in as a part of the visual evidence. If you want a copy of this brochure, we shall be glad to pass your request along.

Zinc Dies

One important lesson to be learned from airplane production experience is the utility of "soft" dies—zinc alloy, lead-zinc alloy, rubber, etc. Adopted about a year ago as a means of producing deep-drawn stampings of every variety without resorting to expensive steel dies, these materials are finding continued application in the greatly expanded war program. "Soft" die materials have had wide use in Europe. One technical report indicates that a pair of "soft" dies is good for 200 to 10,000 pieces, depending upon the nature of the job. Starting with simple drop hammers, the new technique has been transferred to huge hydraulic presses upwards of 5000-ton capacity. There is an opportunity for many organizations in the automotive industry to explore this technique after the emergency is over. It offers a relatively inexpensive means for producing deep-drawn stampings in job-lots; it seems particularly favorable for experimental production runs such as the building of moderate quantities of motor car bodies for show purposes; it seems of value to parts makers and

others. An interesting reference along this line is the handbook of Kirksite zinc-lead alloy for sand-cast dies, distributed by the National Lead Co.

With Powder

Powder metallurgy is fast assuming great stature. Some time ago we mentioned the development of a sintered porous copper alloy powder filter for diesel fuel pumps and for injectors. These tiny elements have been in use for quite some time, have graduated into sizes for the big diesels in railroad locomotives. Now this element has been blown up to larger dimensions and is being groomed for yeoman duty as a fine filter for machine tool cutting fluids. Consider the importance of keeping cutting fluid perfectly clean, what with superfine finishes for airplane engines, for machine guns, for precision gears, etc. Also consider how important it is for centerless grinding, for precision thread grinding, for Superfinish. The filter should be on the market soon. If you are interested, perhaps its introduction can be accelerated.

Photoelasticity

Stemming from ten years of original research work at Carnegie Institute of Technology, a book entitled, "Photoelasticity," said to be the first American work of its kind on the subject, written by Max M. Frocht has been published by John Wiley & Sons. Volume 1, now off the press, comprises eleven chapters of text, making available a comprehensive treatment of the latest theoretical methods and best modern practice in two-dimensional photoelasticity. Two chapters are devoted to the technique of modern stress patterns. Suitable space is given to a review of preliminary optics, including polarized optics, wave theory, electromagnetic theory, double refraction, stress-optic law, etc. Other sections deal with considerations of strain-strain analysis, isoclinics, materials and models. In short, it is a comprehensive text for engineers, research men, and students. Volume 2, which is in preparation, will complete the subject matter, touching upon methods which depend upon additional experimental methods without the use of transparent models.

Strong and Free

An excellent job of public relations is a brochure, "The Strong Shall Be Free," recently issued by the International Harvester Co. In a handsomely illustrated booklet are pictured the areas of national defense activity of IHC tractors and motor trucks—that guns may move, that planes may fly, that men may move, too. Other activities such as the making of shells also are described. The story is topped off with some views taken in IHC plants, showing manufacturing facilities, steel making, personnel. We call it a job well done—and timely, too.—J. G.

OPM Changes Order of Production Priorities

Anti-Aircraft Guns, Ammunition, Explosives Come First; Bomber Production, High on List, Rests Heavily on Ford

Japan's attack on Pearl Harbor and the ensuing declaration of war altered the government's plans on military and naval production and brought forth a new order of priority on armament items from OPM. Under the new priority status, the most urgently needed materials on which production must be speeded up are anti-aircraft guns, ammunition and explosives, naval combat ships, heavy bombers, and merchant ships in that order. This puts tanks, light bombers, army scout cars and trucks in a lower priority classification, at least temporarily, and emphasizes those weapons the nation will use immediately in warring upon Japan.

Automotive plants are heavily involved in the output of these much needed armaments. Anti-aircraft guns are being produced by Chrysler, Pontiac Motor Division of GM, and the Hudson Naval Ordnance Arsenal. Chrysler is producing the complicated Bofors 40-mm. anti-aircraft cannon, a mobile weapon which is mounted on a gun carriage being manufactured by Firestone. Presumably, these guns will be used for defense of coastal cities against enemy bombers. Four hundred of the 1400 machine tools needed to

make the gun's 500 individual parts were taken from automotive production equipment. The operation requires 600,000 sq. ft. of factory space in 11 Chrysler plants and two new gun parts plants. Final assembly is in the Lynch Road plant.

Pontiac and Hudson are producing the rapid-fire Oerlikon 20-mm. anti-aircraft gun, which is mounted on merchant ships and other naval vessels for protection against dive bombers. Pontiac is rushing to completion a new plant addition to expand the output of these weapons.

A large number of automotive plants are producing ammunition and explosives, the next items on the priority list. Shell casings ranging from 37- to 155-mm. are being turned out by Budd Wheel Co., Oldsmobile, Motor Wheel Corp., Chevrolet Gear & Axle, Guide Lamp, and Delco Products divisions of GM, Borg-Warner Corp., Willys-Overland, International Harvester Co., Kelsey-Hayes Wheel Co., and Chrysler Corp.

The automotive industry has a limited part in the building of U. S. Navy combat ships. For several years the

(Turn to page 82, please)

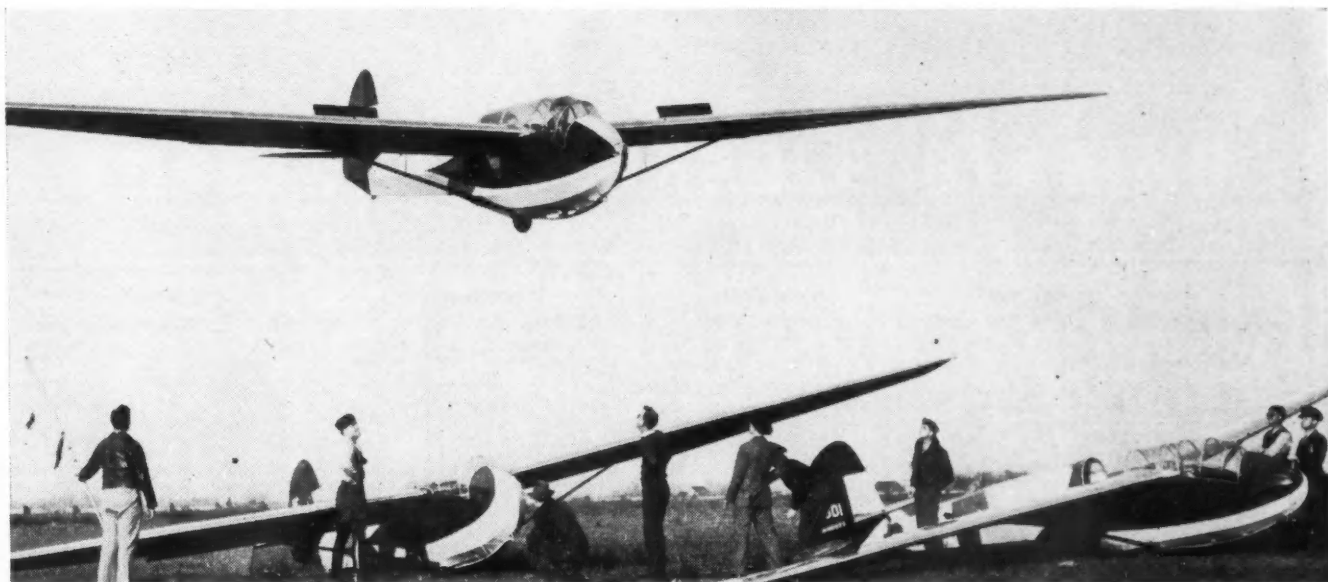
OPA Fixes Price of Reclaimed Rubber

OPA fixed price ceilings December 17 on reclaimed rubber, effective December 20, at the levels prevailing between November 5 and December 5. Every person who sells reclaimed rubber is required to file with OPM on or before January 15 complete price lists for the base period. Affirmation of compliance must be filed on or before January 10 and monthly thereafter whether for immediate or future delivery.

While no appreciable amount of reclaimed rubber is used in first line tires, fairly high percentages are employed in the manufacture of third and fourth line. As reclaimed rubber is the most successful substitute for crude rubber, OPA said that encouragement should be given to substitution by keeping reclaimed rubber prices at a minimum.

Toolmakers to Up Output

Machine tool makers for the airplane, anti-aircraft and machine gun industries met with OPM Dec. 17-18 and pledged 50 to 100 per cent increased production over previous defense requirements. If production meets these figures, W. H. Harrison, OPM's Director of Production, estimated that between \$1250 million and \$1750 million would be spent for tools in 1942. Discussions centered around new productive equipment needs, increased costs, finance, prices and labor problems.

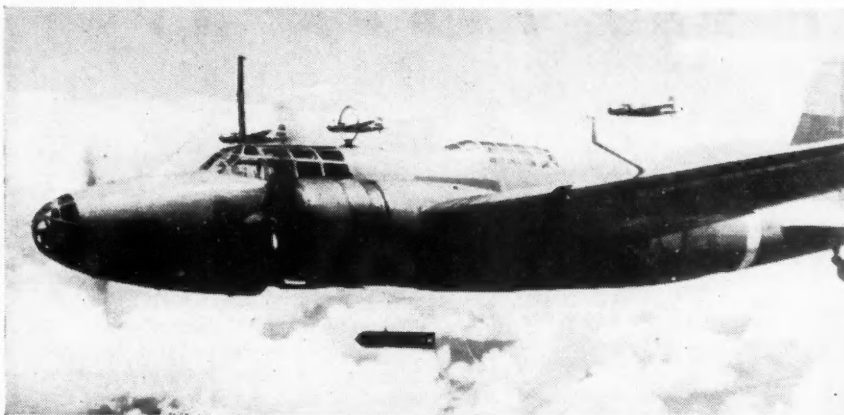


International Photo

Sailplanes for Leathernecks

To conserve gasoline and wear and tear on powered training planes, U. S. Marines are being trained to fly in sailplanes at the Motorless Flight Institute, Ford Airport, near Chicago.

The nucleus of a new glider division, these leathernecks are under the tutelage of Lt. Col. V. M. Guymon, ace pilot of the United States Marine Corps. Note the enclosed cockpit.



Over China Now?

International News Photo

Proudly displayed by the Japs is this photograph of a bomb-dropping plane sailing over a Chinese objective. The outlines of the bomber suggest a German design. It is difficult, if not almost impossible, however, to find any data on Japanese aircraft.

Steel Companies Released From Non-Defense Contracts

Government Assumes Control Over Importation of Tin; Metals Reserve Co. to Handle Distribution of Stock

By W. C. Hirsch

Shelving of the topics that usually are to the front in the steel market at the beginning of a new year, such as the ups and downs of prices in the past 12 months, reflects the rapid transition to a war economy psychology that has been accomplished in the few weeks since the outbreak of hostilities. The American Iron & Steel Institute's estimate of a 1941 output of 88 million net tons of steel is of importance at this time solely because it denotes the nation's superior strength in the most vital of war materials and not because of the gratifying comparisons it affords with the output of other years.

Losing no time following formal declaration of war, automobile manufac-

turers released steel producers from fulfillment of what remained of non-defense obligations so as to make all of their rolling mill capacity available for the production of more urgent war material. Considerable sheet capacity could thus be diverted in the last few days to the rolling of gages suitable for oil steel drums. Extension of control by allocation to steel products other than plates, which are already under it, such as hot-rolled bars and tool steel, is expected momentarily.

Non-integrated cold finishing mills, whose contribution to the war effort is considered highly important, much of their production going into munitions, are clamoring for a more even flow of

(Turn to page 82, please)

SAE Meets Jan. 12 To 16 in Detroit

Thirty-three technical papers will be presented at the 37th annual meeting of the Society of Automotive Engineers at the Book-Cadillac Hotel in Detroit January 12 to 16.

Fred. M. Zeder, vice-chairman of the board, Chrysler Corp., will speak on "The Effect of National Defense Development Work on Future Automotive Engineering." Five authorities will discuss research and design developments in the diesel-engine field. They are: J. S. Bogen, Universal Oil Products Co.; J. L. S. Snead, Jr., Consolidated Freightways, Inc.; Prof. K. J. De Juhasz, Pennsylvania State College; C. R. Alden, Ex-Cell-O Corp.; Lloyd E. Johnson, Caterpillar Tractor Co. Effect of the government's restriction on use of scarce materials for civilian production will be discussed by W. S. James, Studebaker Corp.

Newly-developed data on engine-wear will be discussed by F. L. Miller, Standard Oil Development Co., and J. A. Moller, Pure Oil Co. How field experience was used as a guide to design a high out-put engine will be discussed by F. S. Baster, White Motor Co., and a forum will be held on the subject of "Salvaging for Defense" in automotive maintenance.

A session dealing with six-wheel brake problems, with emphasis on steering and handling will hear discussions by M. C. Horine and W. F. Benning of Mack-International Motor Truck Co.

Girdler Named Vultee Chairman

Consummation of the agreement calling for the purchase by Vultee Aircraft Inc., of 440,000 shares or 34 per cent of Consolidated Aircraft Corp. common stock has been announced by officials of Vultee. Elected as chairman of the board and chief executive officer of Consolidated Aircraft was T. M. Girdler, Republic Steel board chairman.

October New Passenger Car Registrations and Estimated Dollar Volume by Retail Price Classes*

PRICE CLASS	NEW REGISTRATIONS								ESTIMATED DOLLAR VOLUME							
	OCTOBER				TEN MONTHS				OCTOBER				TEN MONTHS			
	Units		Per Cent of Total		Units		Per Cent of Total		Dollar Volume		Per Cent of Total		Dollar Volume		Per Cent of Total	
	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940
Chevrolet, Ford and Plymouth.....	85,965	154,967	51.96	53.42	1,776,721	1,499,065	52.34	54.00	\$76,400,000	\$126,100,000	45.31	46.51	\$1,467,422,000	\$1,153,800,000	47.67	47.60
Others under \$1,000.....	19,929	40,935	12.05	14.11	629,035	843,442	18.53	30.38	19,000,000	37,500,000	11.27	13.83	492,408,000	763,400,000	16.00	31.49
\$1,001 to \$1,500.....	54,989	90,073	33.24	31.05	927,176	412,232	27.31	14.85	65,400,000	100,500,000	38.79	37.07	1,013,852,000	465,100,000	32.94	19.19
\$1,501 to \$2,000.....	4,248	3,695	2.57	.127	52,570	14,741	1.55	.53	7,000,000	5,900,000	4.15	2.18	82,688,000	25,200,000	2.69	1.04
\$2,001 to \$3,000.....	299	433	.18	.15	6,988	6,649	.27	.24	800,000	1,100,000	.48	.40	21,774,000	16,100,000	.70	.66
\$3,001 and Over.....	6	6			77				30,000		.01		395,000		.02	
Total.....	165,430	290,109	100.00	100.00	3,394,490	2,776,206	100.00	100.00	\$168,600,000	\$271,130,000	100.00	100.00	\$3,078,144,000	\$2,423,995,000	100.00	100.00
Miscellaneous.....	55	386			2,059	3,380										
Total.....	165,485	290,495			3,396,549	2,779,586										

* All calculations are based on delivered price at factory of the five-passenger, four-door sedan, in conjunction with actual new registrations of each model. The total dollar volumes are then consolidated by price classes.

AVAILABLE FOR **PROMPT** DELIVERY

With production schedules constantly endangered by non-delivery of essential materials, the elimination of even one such problem is a valuable aid in maintaining maximum output. Torrington Needle Bearings are available for *prompt* shipment on your priority orders!

Right from the start, steadily rising sales curves reflected industry's immediate recognition of the Needle Bearing's advantages. Long before defense requirements brought increasing demands for most industrial materials, Torrington was prompted to expand production capacity again and again, to anticipate growing use of the Needle Bearing.

So broad was the scope of this expansion program, initiated in the light of the Bearing's demonstrated potentialities in normal times and its acceptance by so many of the country's leading

engineers, that it has proved sufficiently flexible to care for the abnormal requirements of the present. Manufacturers of aircraft, automotive equipment, textile machinery, farm implements, electrical apparatus, and many other products have put the Needle Bearing to work in thousands of applications, because of such conspicuous features as low cost, small size, high capacity, ease of installation, efficient lubrication. And today the Needle Bearing has a new and even more important appeal—its ready availability to the makers of defense equipment and machines.

You can avoid delays by incorporating the Needle Bearing in your designs *now*—and you can profit as well by its adaptability to the solution of a wide range of bearing problems. Torrington engineers will be glad to

work with you in incorporating the advantages of the Needle Bearing in your product. For full details on this unusual bearing, write for Catalog No. 107.

THE TORRINGTON COMPANY

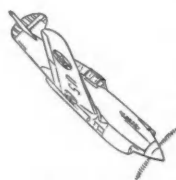
TORRINGTON, CONN., U. S. A. • Estab. 1866

Makers of Needle and Ball Bearings

New York	Boston	Philadelphia	Detroit
Cleveland	Chicago	Los Angeles	Seattle
San Francisco	Toronto	London, England	

TORRINGTON NEEDLE BEARING

REDUCTION IN WEIGHT



and availability when needed are among the outstanding reasons for the use of Needle Bearings in many aircraft applications. A

typical instance is its use on the cowl flap control rod of P-40 pursuit planes built by Curtiss-Wright Corporation.

CURTIS — WRIGHT

COMPLETE RELIABILITY

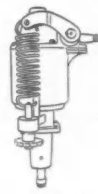


is essential in such materials handling equipment as the Towmotor Lift Truck, which is subjected to severe service and heavy loads. Towmotor assures

reliable bearing performance by using Needle Bearings on steering axle and hydraulic lifting cylinder crosshead.

TOWMOTOR LIFT TRUCK

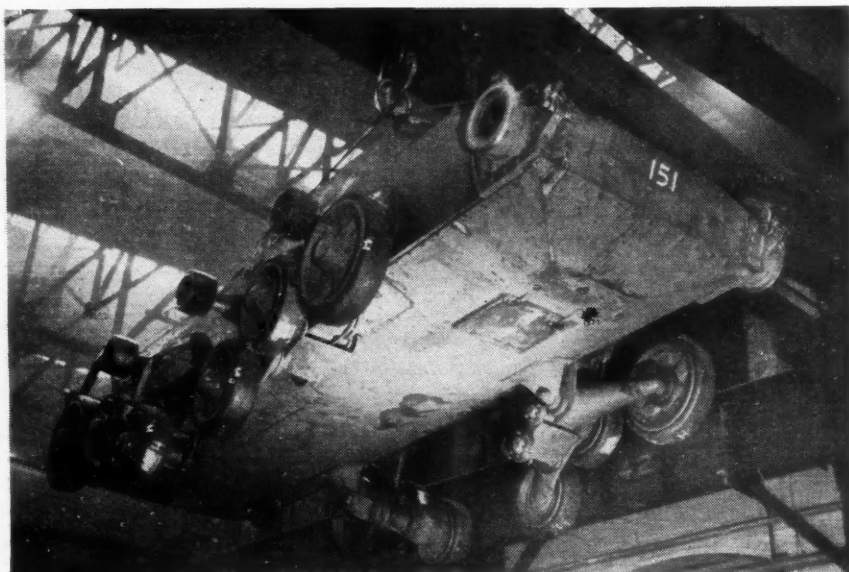
HIGH CAPACITY IN SMALL SPACE



is obtained by the use of Torrington Needle Bearings on the rocker shaft of Class 2600 Governors built by The Pickering Governor Company. Compact-

ness of the Needle Bearing contributes to simplification in product design and to accurate governor operation.

PICKERING GOVERNOR



Valentine Tank

The belly side of a Valentine tank is shown as it is suspended from a hoist in the Angus Shops, Montreal. Fitted with a flame thrower and other fighting equipment, this 20-ton machine has a top speed of 25 mph. Some are destined for Russia.

Liquid Cooled Tank Engines for Trucks

The Ford Motor Co. is reported to be experimenting with an eight-cylinder, super-charged, liquid-cooled engine for use in army tanks and for possible use in trucks. This information was contained in an Associated Press dispatch in the New York Times of December 4 stating that Ford... "planned to use a liquid-cooled, eight-cylinder, super-charged engine of his own design in tanks. The engine is a modification of the twelve-cylinder aircraft engine which Mr. Ford has been experimenting upon for about a year. It has been said that Mr. Ford approved the experimental work on the engine provided his engineers would so design it that it could be installed in a truck if desired."

Tire and Tube Exports Regulated by Defense Board

The Economic Defense Board, Office of Export Control, advised collectors of customs at all ports of entry not to clear, until further notice, the exportation of rubber tires or tubes of any kind, crude rubber, or crepe rubber. These commodities may not be shipped to any destination whatever, unless consigned to the military or naval forces of the United States Government, or the shipment is to be made under provisions of the Lend-Lease Act.

Charles D. Cutting

Charles D. Cutting, 69, president of the Cutting Sales & Engineering Co., died Dec. 16 at his home in Detroit after a long illness. He was a member of the SAE and manufactured the Cutting automobile at Jackson, Mich., in 1910.

Mack Truck Plans Greater Production

In line with the government's policy to have all truck manufacturers increase their production during the year of 1942, Mack has taken the necessary steps to expand facilities and speed up its output of both light and heavy-duty trucks, so that the supply will not only meet the demand of urgent military defense orders, but will also be sufficient to take care of much of its regular business.

In addition to those military types required for the war effort, more than 50 standardized commercial models will be produced during 1942, with units ranging from one to 45 tons. Particular attention will be given to Super-Duty models.

No important change in major units or in the general appearance of the present line is contemplated for the time being, although modification will take place in the bright-work in accordance with the industry's program to reduce non-essential consumption of nickel and chrome.

Employers Urged to Adopt Payroll Allotment Plan

The National Defense Committee of the Associated Business Papers, of which Mr. C. A. Musselman is chairman, is, among its other activities, stressing the importance of the Defense Saving Payroll Allotment Plan. Endorsing this effort, Eugene W. Sloan, executive director of the Defense Savings staff of the Treasury Department, has sent a telegram to Mr. Musselman reading in part as follows:

"You realize that the declaration of war should result in tremendous immediate increase in defense savings. However, this will be insignificant compared to the vast amount of money that must now be raised. Success of defense savings program depends upon speedy, wide adoption of payroll allotment plan."

In commenting on the work along this line which the member publications of the Associated Business Papers are doing, Mr. Musselman pointed out that "the National Defense Committee of A.B.P. has been working with the Treasury for the last two months on a campaign of advertising which is being run by member papers on a purely voluntary basis."

The Treasury Department in its latest advertisement makes it plain that the employee contributing under this plan is under no compulsion; he "decides for himself the denomination of the Bonds to be purchased and the amount to be allotted from his wages each pay day." Any organization employing more than two employees may participate. Each organization

adopts its own application of the idea in accordance with the needs of its own set-up. By writing to the Treasury Department, Section A, 709 Twelfth Street, N.W., Washington, D. C., an employer will be sent a free kit of material being used by companies that have installed the plan.

Eight points are offered in favor of the adoption of the allotment plan. They are:

- (1) It provides money now for vital military equipment.
- (2) It gives every American wage earner the opportunity for financial participation in National Defense.
- (3) By storing up wages, it will reduce demand for consumer goods while they are scarce, thus retarding inflation.
- (4) As it succeeds in retarding inflation, it will reduce the cost of all materials, including defense materials.
- (5) As it succeeds in reducing the cost of defense, it will reduce emergency taxes.
- (6) It reduces the percentage of defense financing that must be placed with banks, thus putting our emergency financing on a sounder basis.
- (7) It builds a reserve buying power for the post-war purchase of civilian goods to keep our factories running after the war.
- (8) It will help reduce the ranks of the needy during that inevitable period of post-war readjustment.

*knew a good thing
when he saw it.*

NINETY years have passed since James Nasmyth, famous British engineer, arranged for a Vermont machine tool shop to equip the Enfield Armory for interchangeable manufacturing.

Today all the democracies need weapons and need them desperately, and the same Vermont tool builders are playing their part in the nationwide effort to arm ourselves and our allies.

The original shop has long since disappeared. The name of the firm has changed more than once. Three generations of eager, active, highly trained men have followed each other to eternal peace, each leaving behind an improved, advanced, more precise, more rapid machine tool technique.

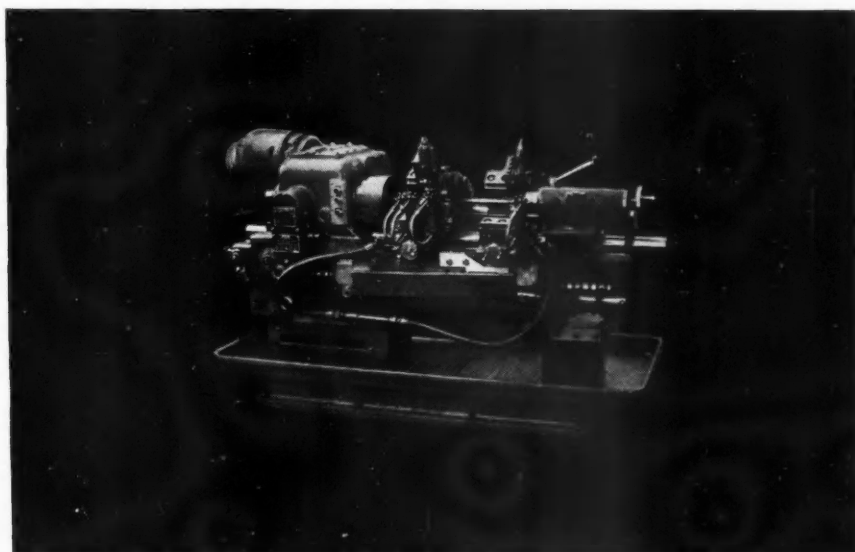
That technique survives, but not even that survives unchanged, for the present generation of Jones & Lamson engineers is continuing to advance, refine and speed it up—with the same spirit and thoroughness displayed by its predecessors.

Herein lie many of the reasons why it pays to put your production problems up to Jones & Lamson engineers. Let Jones & Lamson help you. Inquiries from large plants or small receive careful, thorough study, and illustrated catalogs of Jones & Lamson equipment are available.

J O N E S & L A M S O N

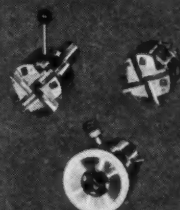
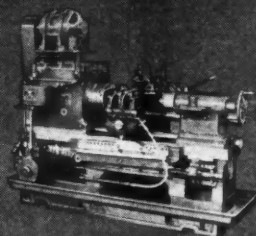
MACHINE COMPANY • Springfield, Vermont, U. S. A.

Manufacturers of Ram & Saddle Type
Universal Turret Lathes . . . Fay Auto-
matic Lathes . . . Automatic Thread
Grinding Machines . . . Comparators
. . . Automatic Opening Threading
Dies and Chasers



Jones & Lamson 8 x 33" Fay Automatic Lathe
tooled to machine an automatic rifle barrel

**PROFIT PRODUCING
MACHINE TOOLS**



**AUTOMATIC OPENING
DIE HEADS**



**SADDLE TYPE
UNIVERSAL TURRET LATHE**

Monthly Motor Vehicle Production (U. S. and Canada)

	PASSENGER CARS		TRUCKS		TOTAL MOTOR VEHICLES	
	1941	1940	1941	1940	1941	1940
January	423,223	375,476	100,835	74,016	524,058	449,492
February	405,160	350,535	104,172	71,690	509,332	422,225
March	422,289	364,947	111,587	75,285	533,876	440,232
April	387,070	375,626	102,784	76,807	489,854	452,433
May	427,538	338,353	117,817	74,139	545,355	412,492
June	427,521	294,779	118,757	67,787	546,278	362,566
July	347,597	172,165	121,298	74,005	468,895	246,171
August	81,689	48,333	83,103	41,533	164,792	89,866
September	170,338	227,880	78,413	56,703	248,751	284,583
October	301,203	428,270	100,157	86,104	401,360	514,374
10 Months	3,393,628	2,976,365	1,038,923	698,069	4,432,551	3,674,434
Year Total		3,802,454		889,884		4,692,338



Stuart's
SOLVOL
AQUAMIX
Liquid Cutting
Compound

"Rough Turning"

Highspeed SHELL TURNING with cemented carbide tools and scores of other tough metal-working operations function better with this genuine new development.

Stuart's Solvol Liquid Cutting Compound, unique in the field of tool lubricants, is already in wide use at many of America's largest and best known munitions plants. It is solving cutting problems and definitely doing its part in speeding up production. Try it quickly and benefit by the obvious improvement and economy.



Photos Courtesy of International Harvester Company

Wire for production sample—free to any concern working on defense.

For All Cutting Fluid Problems
D. A. STUART OIL CO.
Chicago, U.S.A. • LIMITED • Est. 1865
Warehouses in All Principal Metal Working Centers



Urges Development of Guayule Farms in West

In telegrams addressed to Ohio Senators Taft and Burton, and to Congressman Harter of Akron, William O'Neil, president of the General Tire and Rubber Co., demanded that Congress take immediate action to insure an emergency rubber reserve. "There is no shortage today," he said, "and in my opinion there will be none—It is the duty of Congress to insure a rubber supply no matter what happens. The cheapest, surest way to do this is to encourage the development of guayule in the Southwest."

Guayule grows well in this area. Its rubber content runs well above 20 per cent of the dry shrub. With proper seed selection and cultivation this percentage can be raised to around 30. It demands a temperature of not lower than 15 deg., a winter rain of 12 in. or more, and a long dry spell in the summer. While the plant itself grows well during the wet spells, the rubber content begins to rise only during dry periods. The plant produces real rubber which is found in colloidal suspension in the sap. Methods for extracting rubber from guayule are not complicated; Mexican mills have been in operation for years.

At present, approximately 100 tons of guayule rubber are imported from Mexico every month. The yield of this variety is lower than that of the American. According to present surveys, the price and yield of U. S.-grown guayule could be brought to a point where it would be profitable to use it extensively in place of the crude rubber now being imported from areas which are becoming untenable.

Brightwork Ban in Canada Effective Jan. 15

Designed to eliminate the use of metals essential to the war effort, an order prohibiting the use of bright finishes on automobiles was announced by the Canadian Minister of Munitions and Supply. The order, issued by J. H. Berry, Motor Vehicles Controller, becomes effective on January 15. It bans the use of any metal finish or body trim containing copper, nickel, chrome, or aluminum in the production of passenger cars and trucks, and in replacement parts and accessories not scheduled for completion before that date. The only exception to the ruling, patterned after a similar order in the United States, will be in the plating of bumpers and bumper guard assemblies.

Walter L. Marr

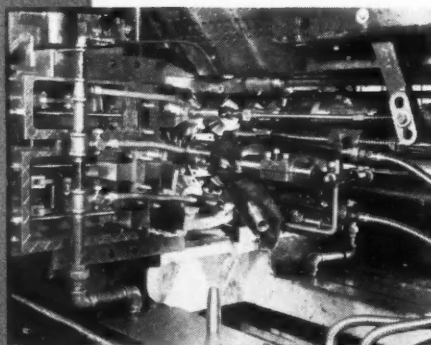
Walter L. Marr, 76, first chief engineer for the Buick Motor Co., died Dec. 11 at Chattanooga, Tenn. He helped develop the valve-in-head engine for the first Buick in 1901 and was chief engineer of the company from 1904 to 1912.



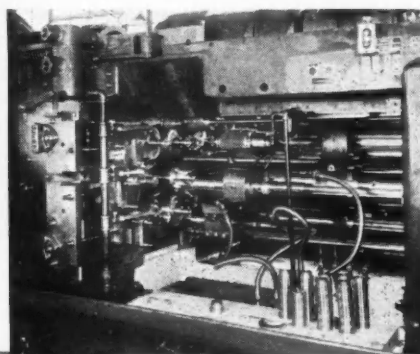
Unbroken **S**upply lines **A**ssured

with

Conomatics



37 millimeter shell bodies coming from 6 spindle Conomatic.



Fuse bodies coming from 6 spindle Conomatic.



Write now for particulars and catalog.



CONE AUTOMATIC

Machine Co., Inc., Windsor, Vt., U. S. A.

Heil Dump Body

The Heil Co., Milwaukee, Wis., recently completed delivery of five 9-cu. yd. dump units for use by the Oliver Iron Mining Co. of Duluth, Minn. The bodies are 13 ft. 9 in. long, and 6 ft. 6 in. wide by 30 in. high. A set of detachable sides increases the capacity of the body 10½ cu. yd. The bodies have scoop ends and are operated by twin-cylinder telescopic hoists.



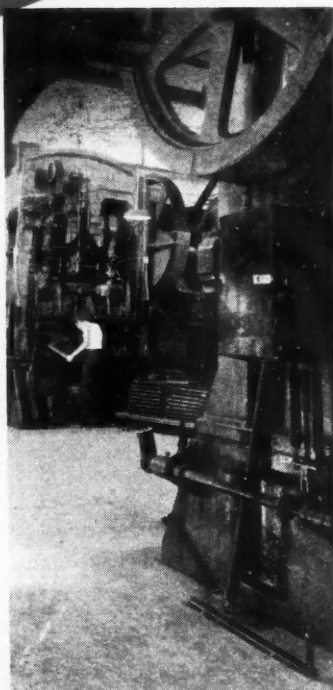
HERE'S what happened when a leading manufacturer of clutch covers asked a Kerns service man to develop a drawing compound to fit the job.

1. PRODUCTION INCREASED 18%

2. SCRAP DECREASED 88%

3. DILLUTION INCREASED 350%

KERN'S DRAWING COMPOUNDS make your work faster, better and easier to clean. They increase die life and cost less per piece.



We are ANXIOUS TO DEMONSTRATE on your TOUGHEST JOB.
• Write or phone for test samples. NO OBLIGATION.

The L. R. KERN'S CO., Inc.

Manufacturers of Industrial Lubricants
2842 East 95th Street • Chicago, Ill.
TELEPHONE: SAGINAW 6656

Steel-Cast Tank Contracts Awarded

Plans of the Ordnance Department of the U. S. Army for the tank production program have resulted in commitments through the Defense Plant Corp. totalling \$53,500,000 for the construction or expansion of rivetless armor casting facilities. Commitments have been made to the following concerns:

American Steel Foundry Co. for the construction of a special armored steel cast foundry; the General Steel Casting Corp., for the construction of a new plant to make armored steel tank hulls and turrets; Continental Roll and Steel Foundry Co., for the construction of a new plant at East Chicago, Indiana, and for the expansion of three existing plants for the production of hulls and turrets; the Scullin Steel Corp., for armored castings; the Symington-Gould Corp., for armored castings.

It is further reported that cast steel hulls are now being made in considerable quantities for the medium tank and that this type of hull is being used increasingly. A minimum of 30 per cent of future production will have the cast steel hull. The balance will be of welded construction. The War Department states that no orders have been issued cancelling production of tanks where riveting is used. This program will be fully carried out. No reports have been received from Libya criticizing the M-3 tanks as was reported recently in news despatches.

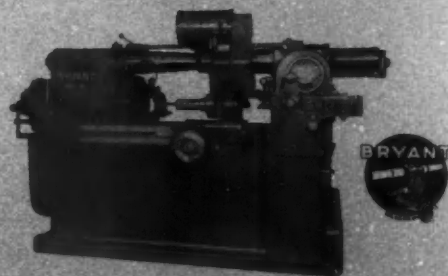
40 Years Ago

When the power and weight of a vehicle exceed a certain limit, the vehicle becomes unsuitable for city use or for the requirements of one who does a good deal of his running in the cities. A vehicle geared to make 30 miles or more an hour on the level road does not operate very satisfactorily at the slow speeds to which it is legally limited in towns, especially if the motor has a hit and miss governor. In other words, an automobile especially developed for touring, having a motor of over 12 horse power, is, in general, unsuitable for city use and may be expected to be bought only by those who intend to tour extensively.
From the *Horseless Age*, January, 1902.

Send in the man from Bryant

If any operation, on any product you make, involves internal grinding, it should pay to see the man from Bryant — to tell the man from Bryant all you can about it, to load him down with blueprints, data, specifications and facts in every available form.

Not only has Bryant stepped up production of modern internal grinding equipment (already tripled, and constantly increasing) — but Bryant engineering is also stepping ahead.



Not only does Bryant recognize the duty of American industry to go all-out for defense, but Bryant stands ready today to help far-sighted management to plan low cost production for peace time goods to sell in tomorrow's competitive markets.

So whether your problem is preparedness now or profits tomorrow, let us send in a man from Bryant.

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

OPM Order Restricts Melting Alloyed Metals

With the outbreak of war, it has become imperative, the Priorities Division declared, to conserve scarce alloying elements used in the production of alloy iron and steel.

To effectuate this, an amendment to General Preference Order M-21-a has been issued, effective January 1, prohibiting producers from melting any alloy iron or alloy steel containing specified alloying elements in specified

amounts, except to fill orders with rating of A-10 or higher, or by special direction of the Director of Priorities.

Alloy iron or alloy steel containing any one or more of the following elements in the following amounts, are covered by the restrictions:

Manganese in excess of 1.65 per cent; copper in excess of .60 per cent; chromium in excess of .60 per cent; molybdenum in excess of .60 per cent; nickel in excess of .60 per cent; cobalt, tungsten or vanadium in any amount specified or known to have been added to obtain a desired alloying effect.

"The situation is well in hand!"

DROP FORGINGS

U.S. NAVY

★ **LABORATORY CONTROLLED**

ATLAS
DROP FORGINGS
ATLAS DROP FORGE CO., LANSING, MICH.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE INDUSTRIES

Continuing steadiness of general business activity is indicated. The seasonally adjusted index of *The New York Times* for the week ended Dec. 6 was 132.7 per cent of the estimated normal, as against 133.4, an all-time peak, for the preceding week and 120.2 a year ago. The index of *The Journal of Commerce*, without seasonal adjustment, for the same period receded to 127.2 per cent of the 1927-29 average from 127.6 for the week before.

Department store sales during the week ended Dec. 6, according to the Federal Reserve compilation, were nine per cent above the corresponding total last year, as compared with a similar gain of 15 per cent for the preceding week.

Contracts awarded for heavy construction during the week ended Dec. 11 totaled \$59,065,000, as against \$81,725,000 a year ago; but the 1941 total to date is 52 per cent greater than the similar sum a year earlier, according to *Engineering News-Record*.

Railway freight loadings in the week ended Dec. 6 totaled 833,375 cars, 3.8 per cent fewer than for the week before but 12.8 per cent above the corresponding number last year.

Electric power production in the week ended Dec. 13 increased more than seasonally to a new peak 14.2 per cent above the output a year ago, as compared with a similar advance of 13.2 per cent a week earlier.

Crude oil production during the same period averaged 4,109,550 barrels daily, 1600 barrels above the average for the week before but 29,450 barrels less than the currently required output as computed by the Bureau of Mines.

Average daily output of bituminous coal during the week ended Dec. 6 was 1,750,000 tons, as compared with 1,936,000 tons in the preceding week and 1,637,000 tons a year ago.

Cotton mill activity in the same period advanced less than seasonally, the index of *The New York Times* standing at 159.6 per cent of the estimated normal, as against 161.6 for the week before and 145.9 a year ago.

Professor Fisher's index of wholesale commodity prices for the week ended Dec. 12 rose to 100.1 per cent of the 1926 average from 99.2 for the preceding week.

Member bank reserve balances increased \$41 million during the week ended Dec. 10, and estimated excess reserves decreased \$20 million to a total of \$3840 million. Business loans of reporting members rose \$82 million, registering a net increase of \$1683 million in twelve months.

OPM Reorganizes

William Knudsen and Sidney Hillman, Director and Associate Director of OPM, have announced organizational changes designed to speed up war production. Under this new arrangement, the industrial branches charged with the responsibility for converting civilian facilities to war-time purposes will now report directly to the Director General and Associate Director General. Formerly, these branches reported to Leon Henderson, Civilian Price Administrator, and to Douglas C. Mackeachie.

MEMO

From the desk of
THE EDITOR
of AUTOMOTIVE INDUSTRIES

To all Automotive and
aircraft Manufacturers:
The 1942 Statistical Issue
of AUTOMOTIVE INDUSTRIES
will be published March 15th
J.C.

In order to provide the automotive and aircraft industries with the latest and most complete data on developments in their fields, the important 24th annual STATISTICAL ISSUE of AUTOMOTIVE INDUSTRIES has been scheduled for March 15th, in 1942, instead of March 1st, as in several previous years.

If you will be kind enough to make note of this revised date on your calendar, and ask your interested associates to do the same, it will be greatly appreciated.

The *Statistical Issue* of AUTOMOTIVE INDUSTRIES is the most valuable reference volume anywhere available to automotive men interested in present developments and past performance presented statistically. Its reference value always makes it the outstanding advertising buy during the early part of every year.

Its value as an advertising medium in 1942 will greatly exceed that of any recent year.

FINAL ADVERTISING FORMS
ARE SCHEDULED TO CLOSE **MARCH 5th** 

AUTOMOTIVE INDUSTRIES

A CHILTON Publication
Chestnut and 56th Streets
Philadelphia, Pa.

Plastic Pistol Grips Used in Place of Walnut

The Ordnance Department has standardized the use of plastics for pistol grips, slide handles on machine guns, and bayonet handles. Companies manufacturing rifles, machine guns, and pistols have been notified they may use plastics or continue to use walnut wood, depending upon the availability of materials.

It is believed that production time and money will be saved as a result of

this use of plastics. Molded plastic grips and handles are capable of faster production. Being exact replicas of the dies in which they were molded, uniformity and accurate assembly to weapons is assured. The plastic substitutes are of the phenolic type. They are required by Ordnance to withstand extreme cold of 40 degrees below zero Fahrenheit without cracking or breaking, and extreme heat of 170 degrees Fahrenheit without softening, blistering or warping. Unlike most commercial plastic products, the plastic bayonet handles and machine gun grips will bear a dull finish.

High-Octane Fuel Production to Be Tripled

Super aviation motor fuels of 100-octane quality are being produced by American refiners at seven and one-half times the rate of consumption of all grades of aviation fuels of only three years ago, and plans to triple even this huge capacity within the next 12 to 18 months are moving so rapidly that already construction has started or contracts have been let for 25 new plants.

Present capacity to manufacture 100-octane motor fuel is about 2,100,000 gallons a day. A few weeks ago the capacity was 1,800,000 gallons a day, but the decision of government purchasers to allow the use of 4 cc. rather than 3 cc. of tetraethyl lead in 100-octane fuel increased the capacity overnight from 15 to 20 per cent.

These capacities are in addition to the continuing manufacture of large quantities of lower-grade aviation motor fuels of 85 and 91 octane rating. Until three years ago these grades made up virtually the entire supply of aviation fuel. The super 100-octane fuel was still in the laboratory seven years ago, and even moderate-scale commercial production did not begin until 1938. In that year the total consumption of all grades of aviation fuel in the United States, by government, airlines, and private fliers, amounted only to 100,000,000 gallons, or about 275,000 gallons a day. In three years the petroleum industry has built new plants capable of making 2,100,000 gallons of 100-octane fuel alone every day, and is straining to add enough more in the next 12 months so that by January 1, 1943, capacity will be close to 5,000,000 gallons a day.

International Nickel Raises Production Rate

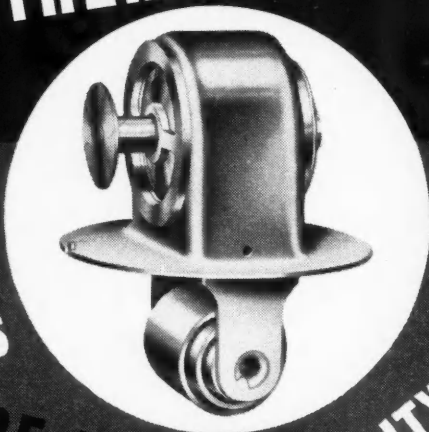
The International Nickel Co. of Canada, Ltd., plans to increase its nickel production by 50 million lb. annually over its 1940 rate. The company has undertaken a \$35 million program which will be completed by 1943.

CALENDAR

Conventions and Meetings

NSPA National Defense Conference,	Chicago	Dec. 11-18
Society of Automotive Engineers, Annual Meeting,	Detroit	Jan. 12-16
Natl. Automotive Dealers Assoc.,	Chicago	Jan. 19-22
Motor & Equipment Wholesalers Assoc.,	Atlantic City	Feb. 23-28
American Society for Testing Materials,	Cleveland	March 2-5
Amer. Society Mechanical Engineers,	Spring Meeting, Houston, Texas,	Mar. 23-25
Natl. Petroleum Assoc.,	Cleveland, O.	April 16-17
Chamber of Commerce of U. S., Annual Meeting,	Washington, D. C.	April 27-30

What DO YOU EXPECT
OF A THERMOSTAT?



ACCURACY
SENSITIVENESS
SURE-ACTION
NON-FATIGUING
BI-METAL
DEPENDABILITY

● Because Dole Thermostats provide all these vital qualities month after month . . . under varying road, load and weather conditions . . . they are helping automotive engineers—achieve new standards of performance. By controlling motor temperatures they assure operating economies and thus protect car builders' reputations . . . just as important in times of emergency as in peace. THE DOLE VALVE COMPANY, 1901-1941 Carroll Ave., Chicago, Ill.

DOLE *Thermostats*
& Thermostatic Bi-Metal



The tactics and grand strategies of modern warfare allow for no exemptions from service. The uniforms, the honors and the insignia of war are the rightful heritage of intrepid youth. But the services of war are the solemn obligation of every man, every machine, every square foot of factory floor space in the entire nation.

So it is that thousands of able, experienced men of General Machinery Corporation, backed up by countless production machines, are devoting their entire time, their exceptional skill and their years of specialized training to the production of the materials and machines of Defense. They also are in the service for the Duration.

GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

THE NILES TOOL WORKS CO. • THE HOOVEN, OWENS, RENTSCHLER CO.

January 1, 1942

When writing to advertisers please mention *Automotive Industries*

61

Unemployment Increases as Auto Production Slows

Conversion of Plants to Defense Work by Next Fall Will Absorb a Majority of the Automobile Workers

Although war has brought faster tempo to automotive plants engaged in armaments production, it has also tended to increase unemployment among those plants still producing automobiles and light trucks for civilian use. Slashing of another 25 per cent off December

passenger car quotas and another 50 per cent off January allotments will bring motor car output to the lowest level for the winter months since the depression years 1932-33.

Priority production curtailments in Michigan automobile factories will have

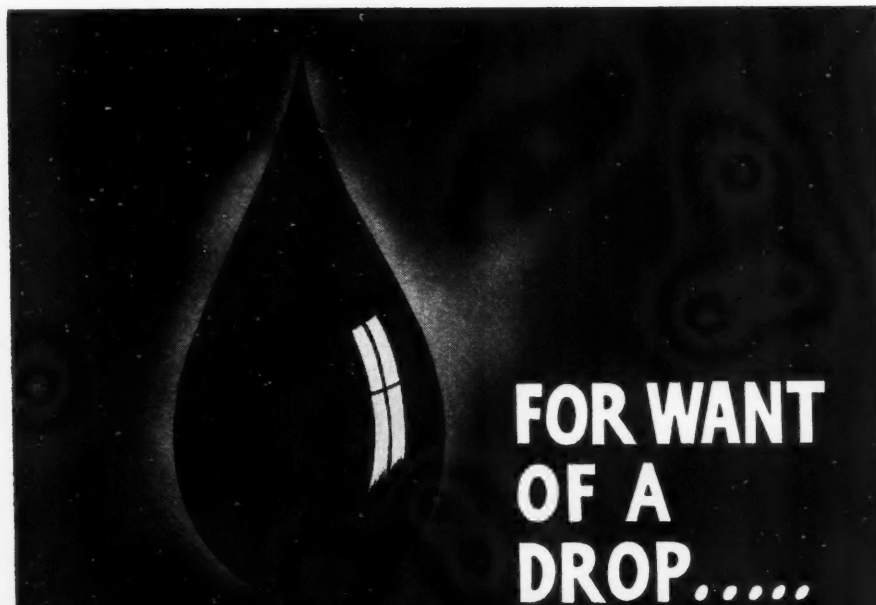
resulted in unemployment of 158,190 workers by January 1, according to quotations from reports to the OPM in Washington. This contrasts with an earlier estimate of only 73,000 unemployed, when the Tolan Committee investigating national defense migration held hearings in Detroit last September. Declaration of war with the Axis powers and the ensuing further curtailment of civilian goods production has more than doubled the unemployment load.

Surveys by the Michigan Unemployment Compensation Commission and the UAW-CIO estimate unemployment in non-defense plants in Michigan will total 250,000 to 300,000 workers in the next few months. War industries will not be able to absorb all these workers before next fall at the earliest, it is generally agreed. Plants like the Ford Willow Run bomber factory and the General Motors and Ford tank projects will not reach any great degree of production before next fall due to the huge tooling jobs required. Stepping up of output of army trucks, machine guns, anti-aircraft guns and other ordnance items will help, but there is a limit to the expansion that can take place in the plants turning out these armaments.

Adding of third and fourth shifts in war industries in order to operate in a 168-hour-week basis will only absorb another 15,000 workers in Michigan plants at the present production levels. Nor are automotive plants able to convert immediately their manufacturing facilities to production of war goods, although labor leaders have asserted that 80 to 90 per cent conversion is possible. Possible complete cessation of passenger car building for a few months after February 1 due to the rubber shortage will accentuate further the unemployment situation. The Michigan unemployment compensation fund, which contained a record total of \$123,437,000 in December, is believed ample to cover much of this unemployment.

The extent to which Michigan's potential defense industries have been converted to production of military and naval products even before the declaration of war is revealed by a report on 1172 plants. This report showed that one third of the 669,787 workers in the plants surveyed, or 222,383 employees, were assigned to defense contract or subcontract work. A survey by the Michigan Department of Labor & Industry for October showed that 14.4 per cent of the man-hours worked in automobile plants were on war orders exclusive of production of cars, trucks, and parts for the armed forces; 47 per cent of the hours worked in automobile parts plants were on war contracts.

Workers from the Chrysler Jefferson plant in Detroit and the Nash-Kelvinator plant at Grand Rapids recently staged demonstrations under the UAW-CIO to protest lack of war orders placed at their plants. The Packard and Plymouth locals of the UAW-CIO and its member locals already have purchased \$12,000,000 in defense bonds.




FOR WANT OF A DROP.....

For want of a drop of oil at the right time and place many new machines have been seriously damaged during initial run-in following assembly . . . To avoid this waste, more and more manufacturers depend upon "dag" colloidal graphite . . . Send for Technical Bulletin No. 112T and name of local supplier.

ACHESON COLLOIDS CORPORATION
PORT HURON, MICH.

"dag" is a registered trade-mark of Acheson Colloids Corporation.



YOU AND WE HAVE AN AXIS TO GRIND!

A single purpose guides all of us today. You and we have but one goal to reach—just one to work and fight and think toward. Every minute of time and every ounce of energy must be directed to that end. It will be done! We all know that.

Here at Accurate we've been busy. Very busy, like you. Machines and men and space are used to capacity. We are cooperating to the limit with our customers—and they with us. But none of us should be satisfied with doing our best. We must do better. That's how America has accepted every Challenge . . . and thereby always achieved its goal.

If you need springs, wireforms and stampings for this job of ours, let us see if we can help you.



ACCURATE SPRING MANUFACTURING CO.
3811 West Lake Street Chicago, Illinois

PUBLICATIONS

Independent - Pneumatic Tool Co. has just issued a new catalog giving descriptions, prices and specifications on its complete line of **Thor** Portable Electric Tools.*

The Nov.-Dec. issue of **Oakite News Service**, published by Oakite Products, Inc., contains a special feature article, **Cleaning Methods That Speed Munitions Production**. The article is of timely interest due to defense demands for greatly accelerated output of munitions.*

16 Solutions to Your Transparent Enclosure Problems with Du Pont Lucite is the title of a booklet issued by E. I. duPont de Nemours & Co. It provides specific advice on machining and forming cast Lucite

methyl methacrylate resin sheeting for airplanes.*

A new die spring bulletin has just been published by the Muehlhausen Spring Corp. It is in color and describes and prices die springs for **high speed presses, regular speed presses and heavy duty presses**.*

Johnson Bronze Co.'s new catalog L-3 covers its line of **Ledaloyl** self-lubricating bearings.*

A folder on **Doall Attachments** has been issued by Continental Machines giving a list of and illustrating all attachments available for use with Doall Contour Sawing Machines.*

A **White Guide to Safety** is the title of an attractive booklet published by Universal Atlas Cement Co. In three parts, Section 1 is devoted to Reflecting Curbs for Safety, Section 2 to Types of White Concrete Reflecting Curbs and Section 3 to Specifications for White Concrete Reflecting Curbs.*

A catalog section on **Reamers** has been issued by Vedoe-Peterson Co. It is illustrated and gives complete specifications and prices on **Nu-Angle Reamers**.*

The current issue of the **Bulletin of the Copper & Brass Research Assoc.** includes information regarding the processing of copper from ore by smelting methods into metals for modern armaments, including brass cartridge cases.*

A 12-page catalog, issued by Leeds and Northrup Co., describes the **Knorr-Albers Microphotometer** for analyzing spectrographic plates or films in research and industrial laboratories.*

Magnaflux Corp. has issued two new folders describing and illustrating various production units for **Magnaflux inspection**.*

Turco Products, Inc., has issued a catalog of Turco products specially adapted to the intricate cleaning problems in the aircraft industry.*

Westinghouse Electric & Mfg. Co. has a new booklet describing **electric furnace brazing** and a folder on power switches for resistance welders, called the **Weld-O-Tool**.*

* Obtainable through editorial department, **AUTOMOTIVE INDUSTRIES**, Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

More Hp. for the Army

The extent to which modern infantry divisions have been mechanized since 1918 was described by Paul Garrett, vice-president of General Motors. He pointed out that in 1918, equipment for an infantry division was 4400 horses and 153 motor vehicles. Today it is no horses but 3500 motor vehicles of 160 types. In 1918 an infantry division had equipment with 3300 hp. Now an armored division has 400,000 hp.

Studebaker School

Stressing merchandising, Studebaker is operating at South Bend, Ind., a school for service men representing dealers and distributors. Meetings will be held each week until members of all the branches have been trained. Two days each week are devoted to merchandising problems, two and one-half to mechanical instruction on new features of 1942 models, and the remainder of the time to discussions with members of the engineering department.

Men and Machines

(Continued from page 41)

Units designed for pressures up to 10,000 lbs. per sq. in. are available.

A NEW, powerful, portable demagnetizer is manufactured by the Ideal Commutator Dresser Co., 3000 Park Ave., Sycamore, Ill. It quickly demagnetizes tools, drills, punches, dies, and work held in magnetic chucks. Metallic dust, flakes, fine chips, etc., can be wiped off easily after a pass across the magnetic poles. Large parts may be demagnetized by moving the demagnetizer over the work.

Enclosed in an all-metal, streamlined case, the instrument contains a light which shows when the current is on. It is designed to operate on 115 volts, 50-60 cycles; current drain is about 5 amp. Weighing 17 lbs., its dimensions are: 5¼ by 10½ by 4½ in.

HAS MANY USES IN AUTOMOTIVE AND AIRCRAFT PRODUCTION

Quiet, smooth operation is assured with felt. As insulation against noise and vibration, and as packing material which retains lubricating oils in important joints and bearings, it is indispensable.

The long experience and unsurpassed facilities of Western Felt Works can assist you in the proper application of felt in your production. Furnished in rolls, or cut to size, Western Felt Products set a high standard of quality and performance in many different automotive and aircraft uses.

Consult Western Felt Works laboratories freely, and without obligation, on any problem in your production which felt may help you to solve.

WESTERN FELT WORKS

4039-4117 Ogden Avenue Chicago, Illinois
Largest Independent Manufacturers and Cutters of Wool,
Hair and Jute Felts. Established 1899.
BRANCH OFFICES IN ALL PRINCIPAL CITIES





DUST PROTECTION SIMPLIFIED

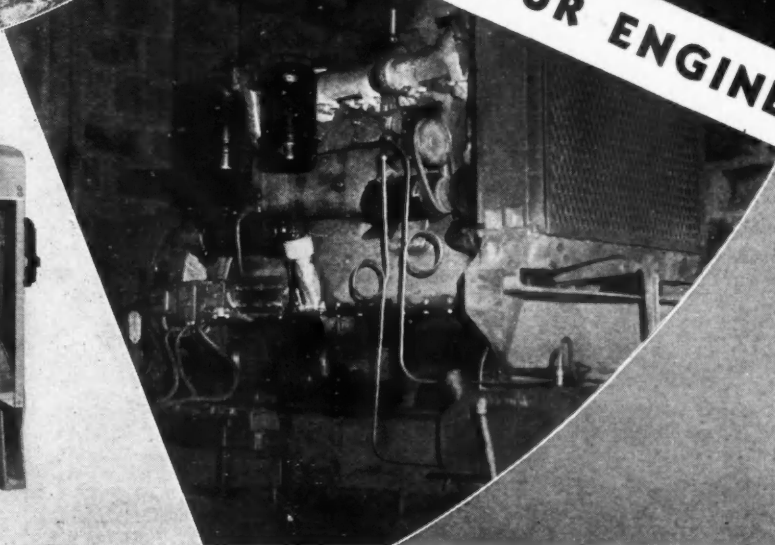
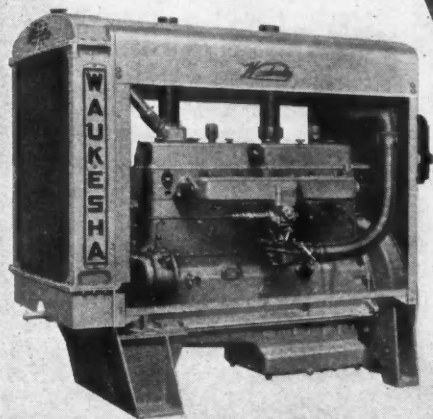


DONALDSON *Oil-Washed* **AIR CLEANERS**

Before Donaldson Oil-Washed Air Cleaners are released they are subjected to rigid tests both in the laboratory and in the field. We are the only makers of heavy duty air cleaners maintaining complete laboratory facilities. With our equipment which includes dynamometers of a size to test 200 horsepower engines, we can determine efficiency, capacity, restriction and horsepower loss. Donaldson Cleaners must be able to meet the worst dust situation anywhere indoors or out, and for either Gas or Diesel engines. . . Today when power performance has new significance for America, Donaldson Cleaners make a definite contribution in simplifying dust protection. . . Write our engineers concerning any dust problem.

DONALDSON COMPANY, INC.
666 Pelham Blvd. Saint Paul, Minnesota

CONSULT OUR ENGINEERS



Tire Ration Plan to Limit Non-Essential Use

Available Crude Rubber Supply and Vehicle Registration Control Monthly Quota; Plan May Become Priority Order

The new rationing plan on the sale of tires which may become effective January 5, looks to the consumption of a mere 10,000 tons of crude rubber per month, approximately 20 per cent of the average monthly rate before the war. Passenger car tires produced from

now on will be a mere dribble, and the production of new truck tires will be curtailed. Controls are being developed over the sale of retreaded tires and the retreading of tires. Price control of tires is expected before the rationing plan is instituted.

Owners of the following classes of vehicles are eligible to receive the certificates or coupons without which tires may not be sold: vehicles required for the maintenance of public safety and health, such as fire engines, ambulances, scout cars, etc.; passenger transportation equipment, exclusive of private passenger cars, and a limited group of essential trucks. Details of this list of users who will be permitted to buy new tires will be issued soon.

The amount of crude rubber available and commercial vehicle registration will control monthly quotas, to be broken down into state and county quotas, and the rationing plan will be issued as a priority order and will carry all the sanctions behind such orders; including the power to withhold priority assistance, including penalties incident to falsification of reports to the government.

Leon Henderson, who announced the plan, said that there were existing stocks of tires amounting to seven million or eight million, but that this was no more than two months supply at the present rate of consumption.

Lockheed Builds Vast Service Hangar

Adding more than three acres to the vast defense production facilities of the Lockheed Aircraft Corp. and the Vega Airplane Co., steel has begun to rise at the Lockheed Air Terminal in Burbank, Calif., on what is believed will be the biggest flight service hangar in the United States.

It is expected that the hangar will be completed and in service within two months. The main hangar will be 150 ft. wide by 800 ft. long, enclosing 120,000 sq. ft. of floor space.

Sixty Firms Aid Ford In Tooling Bomber Plant

The Ford Motor Company is spreading the work of building gauges, fixtures, dies, and tools for its huge new bomber plant at Willow Run. Sixty independent firms in the Detroit area and 12 Ford Village plants in Michigan and Ohio have been assigned more than 50 per cent of the vast project.

Perfect Circle Expands


Final plans have been approved for the erection of a new \$100,000 addition to the laboratory of the Perfect Circle Co., Hagerstown, Ind. Work was started on December 8.

Clarence A. Shaler

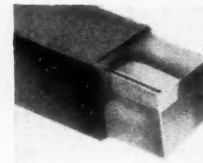
Clarence Addison Shaler, 81, founder of the Shaler Co., Waupun, Wis., manufacturer of tire repair equipment, fell to his death from a balcony of his fifth floor apartment in Pasadena, Calif., where he had been residing since his retirement in 1928.

KENNAMETAL

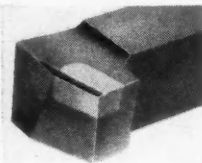
STEEL CUTTING CARBIDE TOOLS



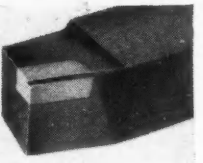
AS MODERN AS THE LATEST PURSUIT SHIP



STYLE 6



STYLE 21



STYLE 11

KENNAMETAL carbide-tipped tools represent as great an advance in the steel-cutting industry as modern 360 mile per hour fighting ships compared to planes of twenty years ago. The introduction of KENNAMETAL in 1938 revolutionized carbide tool practice, for 70% of all cemented carbide tools are being used for machining steel today, as compared to only 30% in 1938. KENNAMETAL has, in fact, become the *accepted* steel-cutting carbide of American Industry . . . more KENNAMETAL tools being used today than any other carbide tool for machining steel.

The ability of KENNAMETAL to machine steel of all hardnesses up to 550 Brinell at maximum speeds and with minimum tool wear has made it indispensable in today's aircraft production. Leading airplane and airplane engine manufacturers now use KENNAMETAL tools for turning, boring, and facing hard-steel parts. Have you tried KENNAMETAL?



"LARGEST
MANUFACTURER
OF
STEEL-CUTTING
CARBIDE TOOLS"

COMPARE THESE DELIVERY DATES Standard and Modified Standard KENNAMETAL tools are now shipped within 10 days of receipt of order; tool tips within 2 to 4 days. Write for Catalog.



McKENNA METALS Co.

105 LLOYD AVE., LATROBE, PA.

Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York
(Exclusive of Canada and Great Britain)

Canadian Agent: KENNAMETAL TOOLS & MFG. CO., LTD., Hamilton, Ont.



Broad Shoulders for a Big Job

With ever-expanding facilities—more manufacturing space, more equipment, more trained craftsmen . . . with ever-increasing energy and enthusiasm . . . the Spicer Corporation is shouldering the job of designing and manufacturing much of our nation's tremendous automotive power transmission needs. We are helping to meet the great challenge to American ingenuity and productiveness . . . a challenge that shall not go unheeded.

Spicer Manufacturing Corporation • Toledo, Ohio

39 YEARS OF
Spicer
SERVICE

BROWN-LIPE
CLUTCHES and
TRANSMISSIONS

SALISBURY
FRONT and REAR
AXLES

SPICER
UNIVERSAL
JOINTS

PARISH
FRAMES
READING, PA.

NSPA Members Plan for Wartime Operation

Manufacturers Acknowledge Importance of Maintaining Repair Parts Business; Terry Elected President

Manufacturers of the replacement parts, equipment, tools and materials normally used in maintaining America's peacetime automotive rolling stock plunged headlong into consideration of the realities of operating under wartime conditions at the annual conven-

tion of the National Standard Parts Association in Chicago, Dec. 15 to 18.

Coming just a week after Pearl Harbor, the meeting, which has been scheduled by NSPA as a National Defense Conference between its manufacturer and wholesale members, developed sig-

nificant overtones beyond those anticipated in a program which necessarily had been drafted before the United States became an active belligerent.

Out of the meetings came the firm conviction that everything possible will be done to keep our present passenger cars and trucks operating—which means that extra attention will be paid to continuing the flow of needed repair and maintenance materials. Aside from the tremendous demands of the armament program, or because of it, the service and maintenance end of the automotive industry has become its most important branch for the duration.

Governmental recognition of the need for repair and maintenance materials was accepted through the OPM production limitation order for January, 1942, which restricts parts manufacturers to the production of one-third of the number of parts made during the first three months of 1941, which in most instances means that manufacturers can produce as many parts during the current month as during the same month a year ago.

Burke Patterson, assistant to the president of Thompson Products, Inc., and retiring president of NSPA, told the manufacturers that in spite of the increased demand for service parts it looks as though the industry will not be permitted to make more than 80 per cent of the parts which it made in 1941, which would indicate some moderation of the January quota later on. He also emphasized that the trend is toward allocation of materials rather than continuance of priorities and said that in the meantime orders from the OPM will indicate the amounts of materials that can be used instead of the number of units that may be manufactured.

Alex Taub, chief of the Conversion Section of OPM's Contract Distribution Division, hinted at what manufacturers may anticipate in pooling of production facilities, spreading of sub-contracts and other measures which can be expected in rapid furtherance of the national "all-out" armament program.

A. T. Colwell, president, Society of Automotive Engineers presented a paper entitled, "The Size of the Defense Program and How It Will Affect Your Business." Lieut. Col. E. S. Van Deusen, chief, Procurement Branches, Motor Transport Division, War Department, discussed the "U. S. Motor Transport Division," outlining progress made in standardization of equipment and in interchangeability of parts; and J. E. Graham, acting chief of the Automotive Section of OPM, discussed "Priorities and Their Application."

Papers on other than defense subjects or direct affairs of the association were presented by T. J. McCormick of the Wage and Hour Division who discussed "The Wage-Hour Law Today;" and Harold Halfpenny, NSPA counsel, who explained the recent cease and desist order issued against General Motors by the Federal Trade Commission.

Taking the place of the usual meetings held by NSPA in connection with

(Turn to page 70, please)



ONLY LAPPING *As Strom Does It* CAN PRODUCE SUCH PRECISION

Strom Steel Balls possess a degree of surface smoothness and sphericity that has never been equalled in any other regular grade of ball. Such precision is exclusive with Strom because it can be attained only through a series of lapping operations such as are standard practice in the Strom plant.

Physical soundness, correct hardness, size accuracy and sphericity are guaranteed in all Strom Balls.

Other types of balls—*stainless steel, monel, brass and bronze*, are also available in all standard sizes.

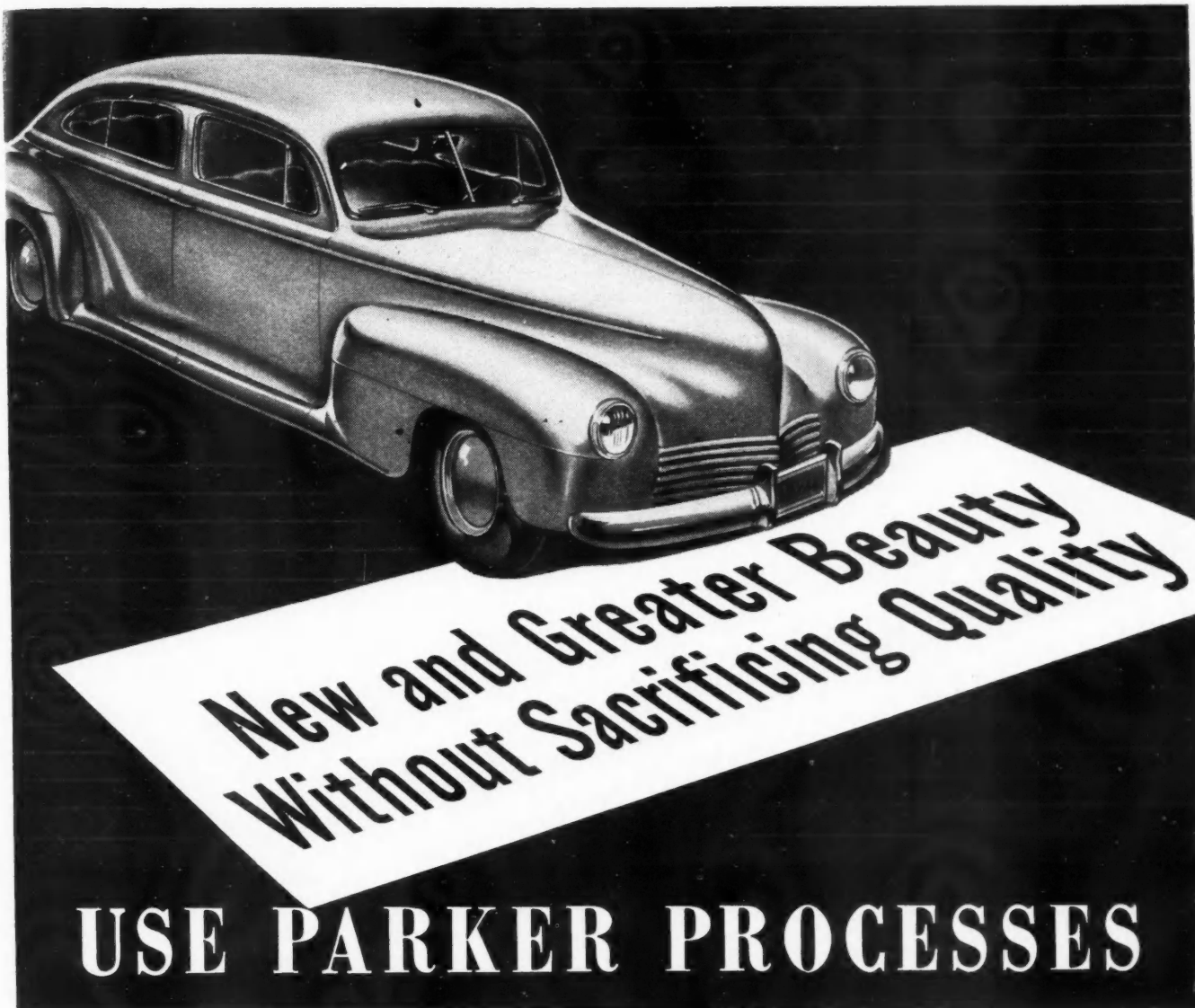
Write for complete details.

Strom

STEEL BALL CO.

1850 So. 54th Avenue, Cicero, Ill.

The largest independent and exclusive Metal Ball Manufacturer



**New and Greater Beauty
Without Sacrificing Quality**

USE PARKER PROCESSES

As leaders in advanced engineering and product styling, as well as in producing equipment for defense, the automotive industry is now pointing the way to greater conservation of defense materials. Without sacrificing either beauty or utility, new finishing methods for various parts are developed that will release chromium, tin, zinc and cadmium to our defense needs.

With Bonderizing as a rust-inhibiting base for decorative enamels, that replace plated units; with Parkerizing for protection from rust on ex-

posed parts; with Parco Lubrizing as an oil retaining coating for friction surfaces, Parker Processes are filling a vital need in the automotive and other industries, without sacrificing either appearance or protective efficiency.

Books describing these processes, where they are used and how they are applied are available to factory officials and technical men. Send for copies.

PARKER RUST PROOF COMPANY
2178 E. Milwaukee Ave. • Detroit, Michigan



PARKERIZING

A finish and substantial protection from rust on bolts, screws and small mechanical parts.



BONDERIZING

A rust inhibiting paint base that bonds the finish to sheet metal surfaces.



PARCO LUBRIZING

A chemically produced coating for friction surfaces that retains oil and prevents metal to metal contact.

PARKER

Processes

CONQUER RUST

BONDERIZING • PARKERIZING • PARCO LUBRIZING

NSPA Plans

(Continued from page 68)

the annual Automotive Service Industries Show, the conference attracted considerable attention because of the technique that was developed to preserve the opportunities for direct personal contact between manufacturers and their distributors in the membership of NSPA. Two floors of the Sherman Hotel were taken over and rooms were assigned to all manufacturers whose executives were on hand to discuss business with their individual wholesalers. Motor and Equipment

Manufacturers Association and Motor and Equipment Wholesalers Association which are planning joint meetings in Chicago in February to replace the cancelled ASI Show were expected to follow a somewhat similar procedure.

R. L. Terry, Sioux City, Ia., wholesaler, was elected president of NSPA for 1942; W. C. Dodge, Jr., Ferodo & Asbestos, Inc., New Brunswick, N. J., senior vice-president; W. J. Menghini, Springfield, Ill., wholesaler, junior vice-president. New directors elected were: W. R. Waddell, Federal-Mogul Corp., Detroit; C. S. Rogers, P & D Mfg. Co., Inc., Long Island City, N. Y.; H. W. Knapp, McQuay-Norris Mfg. Co., St.

Louis, Mo., manufacturers; and D. L. Naylor, Wichita Falls, Tex., A. D. Lacey, Salinas, Calif., wholesalers.

MEN

Carboloy Co., Inc., has centralized its sales engineering department under **K. R. Beardslee**, sales manager. **Martin Muhling**, former special engineering executive and **Earl Glen**, formerly Carboloy Pittsburgh representative, have been appointed to the newly created posts of assistant sales managers in charge of this activity. **R. R. Preston**, formerly superintendent of the wire mill at Page Steel and Wire Co., succeeds Mr. Glen in Pittsburgh.

Samuel Fitzpatrick, formerly export manager for the Federal Motor Truck Co., has been appointed export sales manager for the Mid-West Abrasive Co., Detroit.

Grayson A. Tucker, formerly assistant superintendent of the East Moline Works of the International Harvester Co., has been appointed superintendent of the Auburn Works, succeeding **J. D. Grant**, who has retired after 28 years' service. **C. Cal Johnson**, formerly assistant superintendent of the West Pullman Works, has been named superintendent of the Rock Falls Works, succeeding **Earl C. Lutz**, who has retired after 38 years of service.

F. M. Young, president and founder of Young Radiator Co., was elected an honorary member of Alpha Chapter of Pi Tau Sigma, honorary Mechanical Fraternity. He was honored in recognition of his having "done much to advance the profession and to encourage young men to do likewise."

Peter E. Chance, of New York City, was appointed general manager of the Brake Lining Manufacturers' Assn., Inc., and assumed his duties on Dec. 2, 1941.

Paul W. Rhame, works manager, and **Charles W. Crick**, assistant to the general manager of the AC Spark Plug Division of General Motors Corp., have been named executive assistants to the general manager. Mr. Rhame will continue to head the present machine gun production activity as well as production on new defense items. **Joseph Anderson**, assistant works manager, will be works manager. **Miles Hanson**, superintendent, has been appointed assistant works manager in the machine gun department, and **Lee Sherrod**, superintendent, will be assistant works manager. Assisting Mr. Rhame will be **Morris Allen** on machine guns and **Meredith Spear** on new defense products activity.

George A. Duncan, for the past eight years assistant branch manager for the Waukesha Motor Co., Tulsa, Okla., has been advanced to the position of manager.

Canada Plans

New Magnesium Plant

The Canadian Department of Munitions and Supply has entered into an agreement with Consolidated Mining and Smelting Company of Canada Limited, whereby the latter will construct and operate a government-owned plant for the production of 50,000 tons of magnesium per year. The location of the plant will be decided by the availability of raw materials.

The company has offered to build and operate the plant without fee and without profit. It has built and is now operating under similar arrangements, plants at Trail, B. C., and at Calgary, Alberta. It is expected that the new plant will be in operation in about ten months.



Defense Transmissions MUST Come FIRST!

These giant prime movers for the British army, the largest of the kind ever built, will be used for transporting tanks of the largest size. The complete unit weighs 27,000 lb., net, and up to 160,000 lb., gross. The engine alone weighs more than a conventional 1 1/2-ton truck, and the hood towers six or eight inches above a modern automobile.

Made both by Diamond T and FWD, these huge tractors are equipped with FULLER 4B86 Unit Transmission, FULLER 3A86 Auxiliary, and FULLER 3AX Full Torque Power Take-Off.



FULLER MANUFACTURING CO.
★ ★ ★ ★ **Kalamazoo, Mich.**



The Brewster Buccaneer fabricated with Boots Self-Locking Nuts

Brewster Finds a Way to Cut Costly Assembly Hours

One of the greatest problems of the aeronautical engineer continues to be the development of new ways to speed up production. In meeting present day demands Brewster Engineers cut assembly time with Boots Self-Locking Nuts.

On the Brewster Buccaneer, a special nut assembly known as the Boots "Rivet Saver," particularly, is performing a time-saving func-

tion. This multiple unit nut is engineered to the particular job.

Because they are demonstrably lighter, Boots Self-Locking Nuts save weight. And they are permanent. They literally "outlast the plane."

Boots are the only one-piece, all metal self-locking nuts to pass the rigid tests of Army, Navy and the Civil Aeronautics Authority.

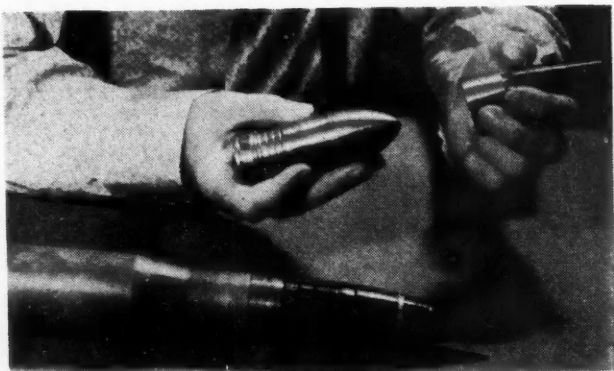


Boots Rivet Saver "Outlasts the Plane"

BOOTS

AIRCRAFT NUT CORPORATION

NEW CANAAN, CONNECTICUT



Plastic Noses

A new plastic to replace the aluminum noses in anti-aircraft and anti-tank shells has been developed by Westinghouse. Shells with plastic noses are shown. The smaller shell is an anti-tank projectile; the larger one is used in anti-aircraft guns.

Canadian Auto Exports Increase 206 Per Cent

Canada's automotive export table during the first 10 months of 1941 reached the all-high record total of \$126,138,178, a gain of 206 per cent over the figure for the corresponding period of 1940, the Department of Commerce reported. Cumulative totals for the 1941 period with figures for the corresponding period of 1940 in parentheses follow: 10,660 (17,321) passenger cars valued at \$5,252,032 (\$6,773,336); 114,180 (45,026) trucks at \$105,118,561 (\$25,740,343); parts worth \$15,767,585 (\$8,690,882). Shipments from Canada of motor vehicles and parts in October were valued at \$11,339,268, a decrease of seven per cent from the September valuation but 60 per cent in excess of the \$7,065,377 shipped in October of last year.

Black-Out Paint

A black-out paint for use in darkening windows and skylights of industrial and commercial properties where it would be impractical to extinguish lights at the sound of an air-raid warning, has been announced by American-Marietta Co., 43 East Ohio St., Chicago.

The paint is being marketed in paste form, and, when cut 50 per cent with water, can be sprayed or brushed on windows to prevent passage of light. Coverage is 800 sq. ft. to the gallon. It dries within 40 minutes, providing a flat surface that will not flash back or glare when hit by artificial light used within the room. Removal of the product, termed Valdura Black-Out, is made without damage to the glass. It is being packed in 1- and 2-gallon containers.

Chrysler Gets Order For Canadian Army Trucks

More than 6000 trucks for the Canadian army and air force were ordered from Chrysler Corp. of Canada. The trucks are to be delivered during the early part of 1942 for use in Empire defense.

GM Drops Income Security Plan

General Motors Corp. has announced that income-security and layoff benefit plans which have been in effect for the past three years have been dropped due to the drop in automobile production, on which the plan was predicated.

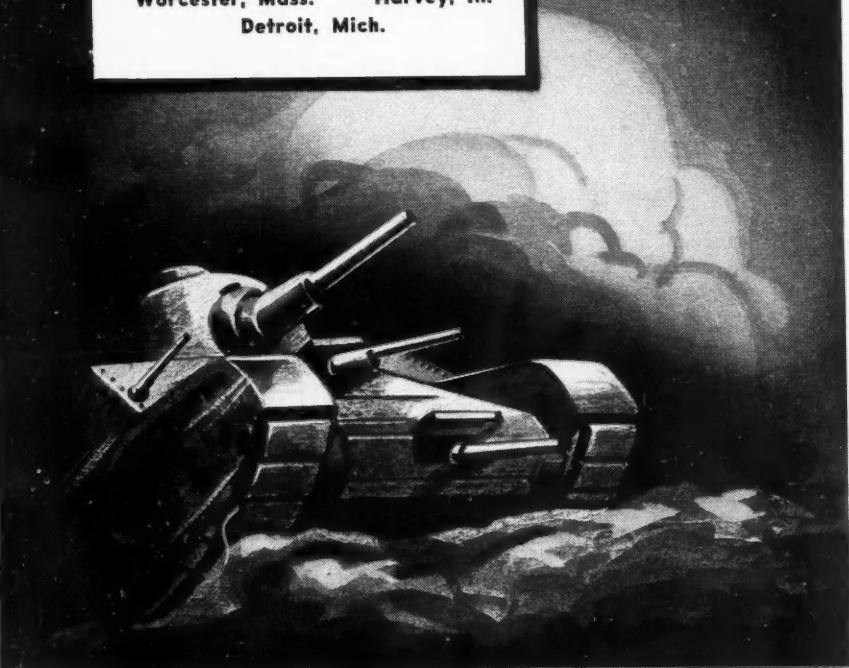
Richard T. Wingo

Richard T. Wingo, 70, president of the Superior Machine & Engineering Co., died December 12 in Detroit after a short illness. At one time he was a designing engineer for the Cadillac Motor Car Co.

Laboratory Controlled
Crankshafts, pistons, and
other vital forgings for
thousands of engines
used in tanks.

WYMAN - GORDON

Worcester, Mass. Harvey, Ill.
Detroit, Mich.



Wyman-Gordon
Guaranteed Forgings



HOW WE INCREASED OUR GUN BARREL PRODUCTION 5 TIMES

80% Savings in time on *both* Drilling and Boring of 37 mm Gun Tubes

This manufacturer (name on request) is setting a new high in gun tube production. Likewise, if you are using conventional single spindle machines, you can save both time and money with this new two-spindle machine. Study these figures:

DRILLING PRODUCTION:

Previous, 2½ hrs. per barrel, floor to floor
Present, 30 min. per barrel, floor to floor

An average of 1.8 inches feed per minute was used to obtain this production, but with TWO spindles working together, the total penetration rate is 3.6 inches per minute.

BORING PRODUCTION: (Ruff & Fin.)

Previous, 270 minutes per barrel, floor to floor.
Present, 52.5 minutes per barrel, floor to floor.

These are the floor to floor times for boring. In addition, a long guide bushing in the quill permits starting pack-bit directly into the previously drilled hole . . . no starting hole needed.

SAVES 50% IN FLOOR SPACE

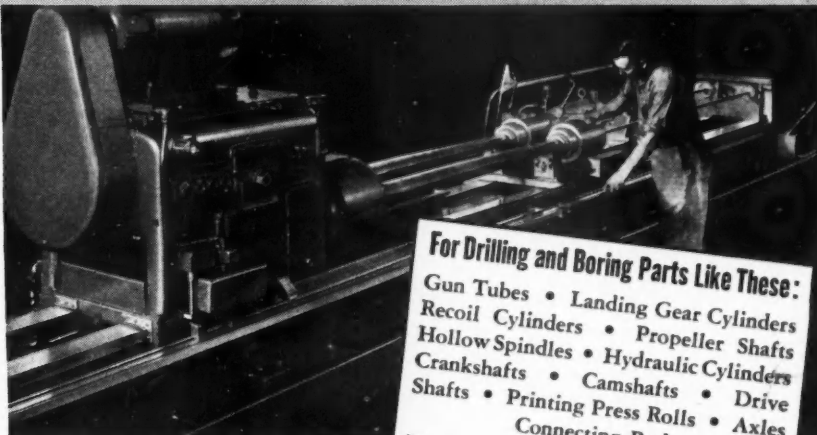
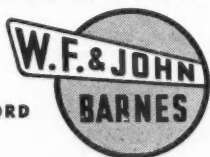
Floor space required for this machine is no more than that required for a single spindle machine. Designed for deep hole and cylinder boring operations, it carries no useless gadgets.

CONSTANT FEED PER SPINDLE REVOLUTION

Spindles and hydraulic pumps are driven by the same motor. This feature insures a constant feed per revolution regardless of fluctuation in motor speed due to variance in loads. Tailstock and headstock are coupled by adjustable tie-bars on both sides. This provides a bearing surface four feet longer than part being machined . . . insures a solid footing for the tailstock.

RIFLE DRILLING, CONVENTIONAL DRILLING AND CYLINDER BORING operations are being performed successfully and economically with the 420. The difference in these and their application to this machine are fully described in the free booklet offered at the right.

DELIVERIES are better than for standard general purpose machines which are not readily adaptable to deep hole operations. We urge you to investigate the possibilities of this machine and place your order early for earlier delivery.



The 420 drilling 37 m/m (1-5/16" Dia.) in gun tube 84" long. Two spindles drill from solid steel at a total penetration rate of 3.6 inches per minute — 1.8 inches per minute feed.

For Drilling and Boring Parts Like These:
Gun Tubes • Landing Gear Cylinders
Recoil Cylinders • Propeller Shafts
Hollow Spindles • Hydraulic Cylinders
Crankshafts • Camshafts • Drive Shafts • Printing Press Rolls • Axles
Connecting Rods
Non-symmetrical parts can be machined by using cradle-type fixtures.

5 IMPORTANT FEATURES

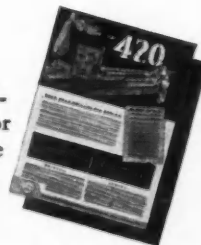
- ★ Two spindles work together . . . double production in same amount of floor space taken by single spindle machine.
- ★ Feeds and spindle speeds always in definite relation . . . constant feed per revolution.
- ★ Massive head together with long bearing surface permits heavy feeds . . . better production.
- ★ Pack bit boring can be done without boring preliminary guide hole — one operation eliminated.
- ★ Hollow spindles permit removal of pack bit without returning through bore . . . no scratches.

5 DEEP HOLE TOOLING SET-UPS

are illustrated in this bulletin. LINE drawings trace coolant path and illustrate cutting operations on drilling, boring, and reaming deep holes. Packed full of useful up-to-date information, this bulletin will help you simplify a tough job.

FREE!

DEEP HOLE DRILLING DATA. Write for this useful deep hole drilling and boring information today. Ask for bulletin A.I. 420.



McCulloch Superchargers in the Making

(Continued from page 24)

boring heads, permanently fixed and providing an arrangement that takes care of every housing in the line. The small housing is bored with the first two heads; while the larger housings are handled with the two cutter heads. Ramet-tipped cutters bore these small holes to size.

Gear Department

The gear department is a self-contained unit equipped with the necessary machinery for gear cutting and inspect-

ing, as noted in the table on page 22. Generally speaking, the gears are finished by hobbing, followed by shaving, as will be noted in the routing given on page 24.

Finished gears are checked for involute accuracy on an Illinois checker, for lead on a Michigan lead checker, then are run-in on a Red Ring gear speeder.

Miscellaneous

In the group of drilling and tapping

machines listed in the table on page 22 will be noted a number of the versatile Delta and Walker-Turner bench-type drilling machines; and the Bake-well precision tapping machine which is fitted with an external lead screw.

A 24-in. Colonial "Utility" broaching machine of vertical type is used for various broaching jobs, particularly for the broaching of a short internal spline which is cut in six different operations, with six short tools.

Finally, a brief comment on the block test department in which the assembled superchargers are run on a specific test schedule before being OK'd for shipment to the customer. At this writing there are two test stands, both fitted with an external lead screw.

ing the supercharger. One of the engines is equipped with a McCulloch Ford supercharger to provide extra power for the larger units, which require as much as 110 hp. to drive them at rated speed and output.

A great deal of attention has been given to the design of the test equipment so as to eliminate any possible nuisance due to noise. For example, the inlet side of the test set-up takes in air through a big Burgess silencer. The outlet side is carried through suitable piping under the floor to a huge stack fitted with an effective silencer so as to muffle the sound of the exhaust.

In addition to the foregoing there is an experimental department for continuing research on improvements and new developments. This department has several electric dynamometers for driving test superchargers, with suitable instrumentation for taking test data.

Automatic Welding Aids Clutch Production

(Continued from page 30)

filler wire is fed through the lower. The welding of both the inner and outer diameter of the shell to the forging is done at the rate of 20 per hour. In production a batch of 40 or more are run through to weld the outer diameter. Then the fixture is changed and the inner diameter is welded.

The next step is the heat treatment, which is an annealing operation. Next the shell is machined and the fins welded on the outside and inside of the shell. The parts, which are enclosed, then are placed within the shells and the outer diameter welded. This latter operation has not as yet been struck, but the carbon may be seen approaching the work. The welding of this outer diameter, which is 13½ in. across, is done at the rate of 20 per hour.

Houghton Expands

E. F. Houghton & Co., Philadelphia manufacturers of oils, leathers, and metal-working products, have occupied their new ultra-modern office building. Increased facilities for the production and shipment of the company's products have been provided.



3 Great Tools

FOR DEFENSE PRODUCTION

DURO

DRILL ★ PRESSES



Duro slow speed — high speed — table models—floor models—single spindle —two spindle—four spindle drill presses are available.

Here are presses that have stability. Presses on which you can depend. Presses whose performance is notable.

Careful machining of superior materials, correct balancing, the use of four ball bearing spindle support, rigid construction, careful assembly, detail inspection assures you long satisfactory drill press performance.

Get the facts.



DURO METAL PRODUCTS COMPANY

Dept. AI-13

2649 N. KILDARE AVENUE

CHICAGO, ILLINOIS

For DURABILITY use

DUROBILT★TOOLS



Wherever the going is tough—Shuler Front Axles help keep Euclids going!

PUNISHING LOADS ARE "MADE TO ORDER" FOR SHULER AXLES!

Because Shuler Axles are built to take the worst kinds of beatings, you'll frequently find them where the going is toughest—on road-building jobs, in logging camps, in coal mines, hauling torture loads on huge transport trailers.

Yet *toughness* is only one of the reasons why so many builders of heavy-duty automotive equipment specify Shuler Axles. *Ease of steering* is another. *Competitive price* is a third.

Shuler Axles won't let you down when the going gets tough. Neither will their makers. Give us a chance to prove it!

SHULER AXLE CO., Incorporated, LOUISVILLE, KY.

Export Division: 38 Pearl St., New York, N. Y.

*West Coast Warehouse: Ford & Derby Streets,
Oakland, Calif.*

BETTER SERVICE!

Many of Shuler's best customers were first won by our eagerness to be helpful in emergencies—such as in rapidly getting out troublesome "specials" and small orders. We invite you to test our cooperativeness on any of our products:

Shuler Square and Tubular Trailer Axles

Shuler I-Beam Trailer Axles for Utility or House Trailers

Shuler Front Axles for Trucks, Tractors, Farm Machinery, etc.

Shuler Truck and Trailer Brakes

Shuler Heavy-Duty Brakes and Trunnion Axles for Low-Platform Heavy Duty Trailers

Custom Forgings

SHULER

AXLES AND BRAKES

West Coast Airplane Industry

(Continued from page 39)

mass-production methods, operates a large machine shop containing the latest types of metal cutting equipment of familiar makes. As in other plants on the West Coast, the handling of small parts, small sub-assemblies, instrument assembly, and the fabrication of bent tubing, all are done on the mezzanine gallery away from the bustle of activity on the main assembly floor.

Here too, is a large zinc foundry, pattern shops, modern press shop, and a drop hammer shop which is served by the foundry.

The Dallas plant is said to be the first "blackout" airplane factory built in this country. It is windowless, air-conditioned, and artificially lighted. The main factory building, 900 by 950 feet, with 855,000 square feet of floor space all on one level and under one roof, is believed by the designers to be the largest industrial room in the world. It is of concrete and steel construction throughout, and the exterior walls and roof are composed of cellular steel units with heavy insulation. A mezzanine floor at one end of the final assembly

bay houses production and engineering offices. While the factory is not bomb-proof, its construction minimizes possible damage from bombing raids. The steel walls and roof would not splinter as masonry does.

We have reproduced a floor plan of the Dallas plant showing the flow of material and process from the raw materials stores to the final assembly department.

The operations at Inglewood are so extensive as to defy sketchy description. For this reason, we shall make the presentation pictorial, in the main, using illustrations typical of selected points of interest.

Vultee

Early in 1941, Vultee holding the largest order ever placed, in number of units, for one type of airplane began the installation of the first powered mechanized final assembly line in the industry at that time. Within the month the company had exceeded contract schedule deliveries of basic trainers to the Air Corps by 83 per cent. Operation of the new conveyor system was coordinated with a re-alignment of manufacturing facilities along mass-production lines so that every phase of activity was synchronized with the final assembly line. The new assembly line involves an overhead conveyor system running some 6200 feet.

More recently the final assembly line has been mechanized by the installation of a floor conveyor, synchronized with the speed of assembly operations. The overhead monorail feeding engines to the final line now is synchronized with the assembly conveyor movement, and provided with a photocell arrangement for positioning the engine in precise relation to the engine mounts.

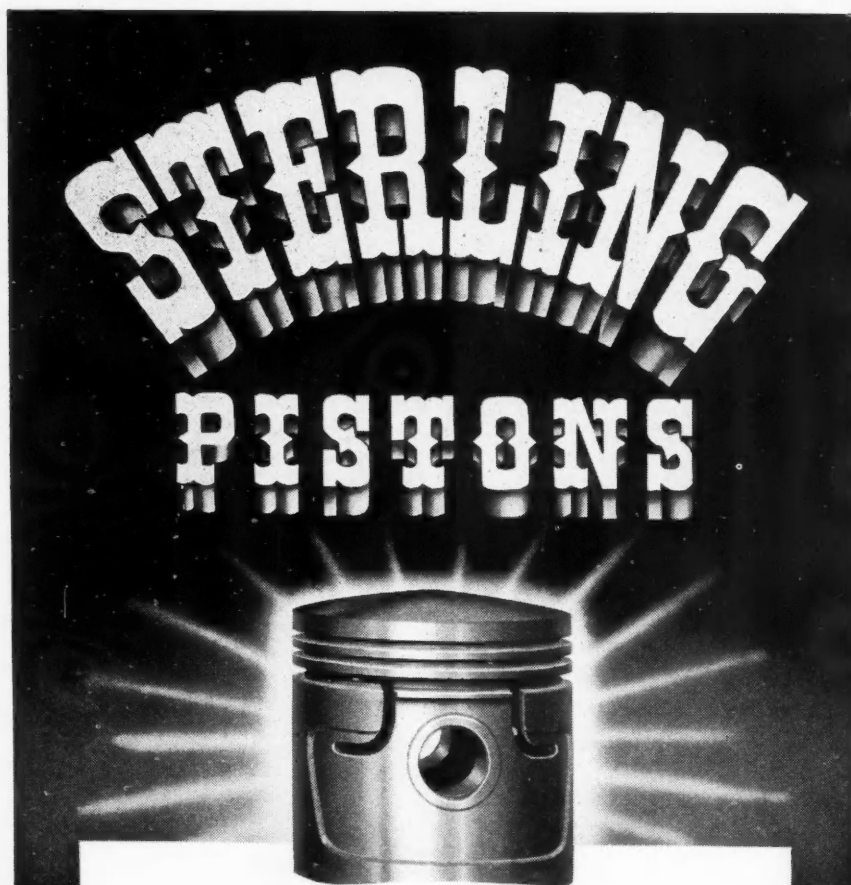
In organizing the assembly process, Vultee breaks down the ship into five major units—fuselage, tail section, engine assembly, center wing section, and outer wings. Each of these units is handled in a separate sub-assembly department. The monorail system serves to bring them together at the final assembly line.

Vultee has one of the largest machine shops in this area and operates a large screw machine department. Included in these are machines such as Gisholt turret lathes, Warner & Swasey turret lathes, Keller machines, Cincinnati milling machines, Cincinnati Centerless grinders, Kearney & Trecker milling machines, and many other types and makes.

The press shop boasts a 350-ton Minster press and a battery of 150-ton Minsters. Too, there is a huge 2400-ton Birdsboro hydraulic press with a rotary table, permitting the loading of small dies while a section of the table is under the ram.

Vultee is said to have pioneered the electric arc welding method for the fabrication of tubular fuselage sections.

In the heat treat department, a huge salt bath furnace includes handling equipment with a lifting speed of 125



DESIGNING TO THE FUTURE

Sterling engineers are today collaborating with engine builders in developing the pistons of tomorrow. With a background of millions of Sterling Pistons now giving satisfactory service, we are prepared to help you solve your piston problems.

**STERLING ALUMINUM
PRODUCTS, INC.**
SAINT LOUIS

**SPEED UP PRODUCTION AND GET BETTER
FINISH ON SURFACES FOR GASKETS**

**WITH
NEWTON
MILL-N-SHAVERS**



NEWTON Mill-N-Shavers that speed up production by performing rough milling and finish shaving in the time ordinarily required for rough milling alone, are particularly valuable in these days when accelerated production is the need.

And with Newton Mill-N-Shavers you get a much smoother and more accurate finish. That is why these machines are preferred to rough and finish milling, particularly where an exceptionally smooth surface is required as for gaskets.

NEWTON MILL-N-SHAVERS may be able to help you turn out better work in quicker time. Bulletin #580 tells more about this new method of surface finishing. A copy is available upon request.

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

**C O N S O L I D A T E D
M A C H I N E T O O L C O R P O R A T I O N**
R O C H E S T E R , N E W Y O R K

fpm. Racks of parts are immersed in a bath containing some 48,000 pounds of molten salt held at a temperature of 925 deg. F., then dipped in a tempering tank at the rate of 1200 pounds of metal per hour.

The plant now employs some 350 women workers on around 30 different types of production jobs such as aluminum welding, precision inspection, and hand turret lathe operation. Many of them are employed on the final assembly line.

Precision assembly operations, particularly of electrical units and wiring harness, are done on the mezzanine floor.

For These Things We Now Fight

(Continued from page 17)

pose of getting a reward or making wages or earnings. The result is that the opportunity for such reward or compensation is largely responsible for determining the type of activity engaged in by an individual.

Second: Individuals are free to manage their affairs with only that governmental regulation or interference necessary for the protection and enhancement of the general welfare.

Third: Individuals are permitted to

enjoy the fruits of their labor and activities subject only to limitation of the right of the community, acting through its freely chosen representatives, to determine, (a) that certain types of business or business practices are undesirable or need to be controlled; and (b) that a portion of the community's aggregate income should be collected through taxes and expended for specific public purposes with a view of enhancing the general well-being of the people.

Fourth: Prices are determined by the free play of competitive forces except in those industries which are designated by proper governmental authority as affected with the public interest. To these principles I should like to add several others:

The first is that a free flow of capital is essential for successful industry.

Since we shall have future Edisons, McCormicks, Goodyears, Wrights and Bells yet to come with their new inventions, another is freedom of management which is essential in the undertaking of new ventures.

A third is freedom of competition, which up to date has been the spark of industrial progress! And, of course, freedom to work, with or without a union card.

As against these essentials on the one hand, there are obligations on the other:

First, to further demonstrate that industry can be trusted to work for the advancement of the nation.

Second, to recognize that industry has responsibilities to society and is willing to bear its share of them.

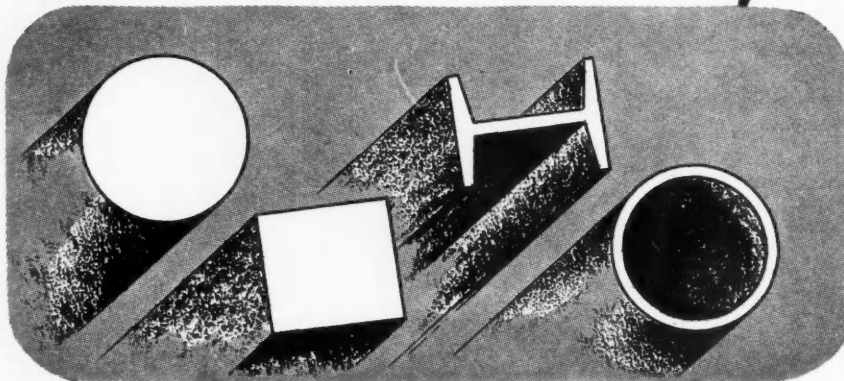
Third, to recognize the rights of labor to collective bargaining, fair wages and wholesome working conditions.

Fourth, to be willing to adjust itself and its operations to sound social change.

While we are engaging in this intense war production, let us preserve the principles of our free enterprise system and especially the independent initiative of the individual.

This has been responsible for the achievements of America. We must see to it that it is preserved through the present crisis in its full vigor and vitality.

CUTTING METAL? *Here's Real Versatility!*



Wells SAWS
THE SIGN OF SERVICE

Now Built in 3 Sizes
No. 5—5" dia. round or
5" x 10" flat.
No. 8—8" dia. round or
8" x 16" flat.
No. 12—12" dia. round or
12" x 16" flat.

Also the No. 9 Upright Saw.

WHERE accurate, dependable metal sawing is required, day-in and day-out on a wide variety of jobs, Wells Metal Cutting Band Saws are the low cost solution. Built right, they fit the production, maintenance and 1001 odd jobs around the plant. They're portable, too, and can be put to work wherever they're needed. Write today and find out what Wells Saws can do for you.

WELLS MFG. CORP. Three Rivers
Michigan

Sterling Opens New Assembly Plant

With the opening of the partly completed \$500,000 assembly plant of the Sterling Engine Co., Buffalo has become one of the country's leading producers of marine engines.

First to come off the plant's assembly line were five 1200-hp. Sterling Admiral engines which will be installed in British torpedo boats. The firm has British orders for 400 of this type engine.

TRANSMISSION GEAR *Synchronizing* RINGS

Bunting has specialized in the manufacture of Transmission Gear Synchronizing Rings since the early stages of this important engineering development.

The majority of such rings used in power transmissions are made by Bunting and from a special alloy developed to embody the correct physical properties and frictional characteristics.

We are prepared to execute orders for any desired quantity of large or small units. The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in all principal cities.

FOR TANKS, TRUCKS,
AUTOMOBILES, BUSES,
POWER TRANSMISSIONS,
SPEED REDUCERS,
MACHINERY
GEAR BOXES



BUNTING

BRONZE BUSHINGS
• BEARINGS •
PRECISION BRONZE BARS • BABBITT METALS

Brazing Carbide Tips on Tools

(Continued from page 25)

back side of the tip, this work should be done during the brazing cycle by applying the torch on top of the tip, using Easy-Flo No. 3 rod.

Due to the difference in the rate of contraction between cemented carbides and steel, it is necessary to cool the tool slowly to avoid cracking the tip. This may be done by burying it in powdered charcoal, graphite, asbestos, mica, or lime. Tools should never be cooled by quenching.

Buick Motor Division of General Mo-

tors has found that for all classes of work throughout its plants, all different carbide tools can be produced from 11 different sizes of carbide tips, thus simplifying materially the problem of tip inventory. Buick's method of brazing tips on shanks is here described.

For the first operation, shanks of SAE 1340 steel are ground to size on all four sides from hot rolled stock (containing no strategic tungsten) on water type surface grinders. From here they go to the milling department where the

recess for the tip is milled out, and the shank is stamped, ready for brazing the tip in place. The tip itself is polished on bottom and contact sides with a diamond wheel.

Using city artificial gas makes the brazing setup one of the fastest yet developed. The brazing equipment (see photograph) consists of a fixture having a flat top, on the back of which have been attached six fishtail gas tips arranged in such a position that the tool, held in a vise, can be slid into position between three flames on each side. The vise itself rests on the flat surface of the fixture. The operator thus has both hands free with which to handle the tip and brazing material to assure getting a good braze. While one tool is heating, the operator prepares another tool for the vise.

Tool shank and tip are first cleaned by dipping in carbon tetrachloride. Handy Flux and Easy-Flo No. 3 are then applied, the tool is clamped in the vise and the tip is placed in position in the milled recess and covered with flux to prevent oxidation. The assembly is then slid forward, bringing the tool into the flames in such a manner that the flames contact only the lower part of the tool shank. This avoids direct contact of flames with the tip and brings the brazing end of the shank up to soldering temperature, about 1400 deg. F.

As the tool heats up and approaches a cherry red, brazing wire (Easy-Flo No. 3-3/32 Wire) is brought in contact with rear of carbide tip and allowed to flow under and around the tip. Using a 3/16 rod with sharpened point, excess brazing material and air is removed by moving tip back and forth in recess of tool shank. The operator then brings the fixture back away from the flames, and while holding the tip firmly into the recess allows it to cool to a point where the brazing material solidifies. This is at around 1175 deg. F. for this grade of Easy-Flo. Next he removes the tool, removes flux in hot water and passes on to the next one.

When the tool is cool it is shot-blasted and goes into temporary stock as a "milled and brazed" tool. From this stock it is drawn out for finishing of the profile of the tip to the required final shape in one of the numerous Buick grinding rooms or service departments.

Around-the-Clock Operation at Republic

In compliance with the request of the War Department, Republic Aviation Corporation, manufacturers of Thunderbolt interceptor planes, have inaugurated a three-shift, "around-the-clock" seven-day work week, President Ralph S. Damon announced. The former two-shift, twenty-hour schedule will give way in department after department to an arrangement for three shifts of eight hours each. Workers on both of the night shifts will receive wage premiums.

37 MM. A. P. Shot Cap

HOLLOW MILLED...

UNDERCUT...

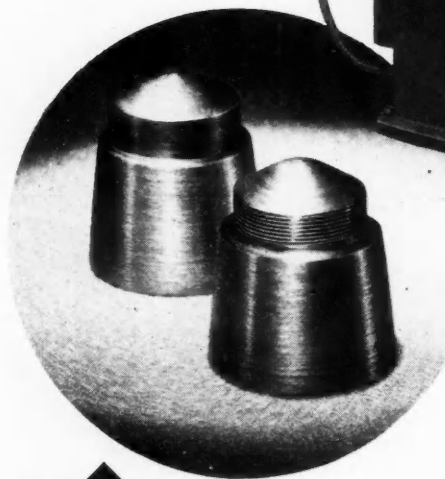
POINTED...

THREADED...

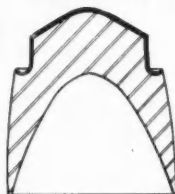
ON R-J AUTOMATIC INDEXING MACHINE

CAPACITY: 180 PCS. PER HR.

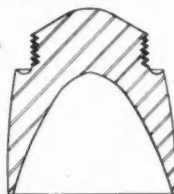
One of the many outstanding unit-type machines designed and built by Rehnberg-Jacobson to accelerate war production. To solve *your* production problems, consult Rehnberg-Jacobson.



FIRST OPERATION SECOND OPERATION



Profile is automatically and completely finished by inserted-blade hollow milling tool.



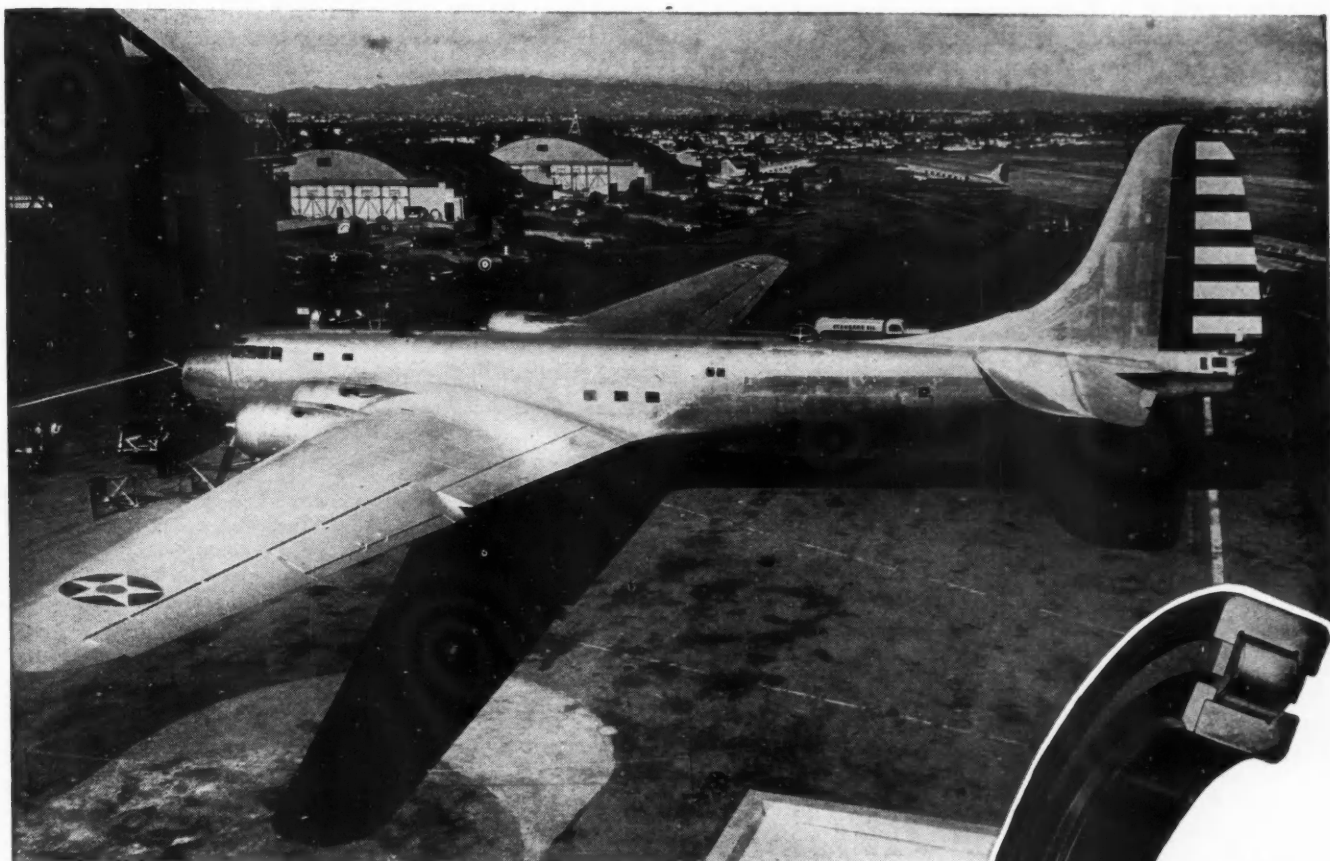
Threading automatically accomplished by chaser-type die head. Accuracy assured by precision ground lead screw.



REHNBERG-JACOBSON MFG. CO.

Special Machinery

2137 KISHWAUKEE ST. • ROCKFORD, ILLINOIS



Nicknamed the "Hemisphere Defender," the B-19 built by Douglas Aircraft Co., Inc., is powered by four SKF-equipped engines built by Wright Aeronautical Corp. The SKF Bearings have a one-piece retainer permitting ease of disassembly and a thorough inspection of all parts.



The Biggest Thing in the Air

FLIES WITH SKF BEARINGS

Here's tomorrow's guide in designing giant cargo and troop transports. It's the B-19 with a wing spread of 212 feet. It's capable of flying non-stop more than 7700 miles. And its four

2000 h.p. Wright Cyclone 18's provide the power, using SKF Bearings. No matter how big nor how small the planes today, they're SKF-equipped at one or more locations.

4882

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILA., PA.



ROLLER **SKF** BEARINGS



January 1, 1942

When writing to advertisers please mention Automotive Industries

81

Steel Makers Released

(Continued from page 46)

the hot-rolled material which, it is expected, allocation will bring about. There is still a considerable gap between maximum ingot supply and finishing mill capacity, aggravated for the time being by inadequate scrap deliveries to mills and by blast furnace limitations. The latter shortcoming is expected to be ameliorated through plant additions, some of which are expected to be in operation late this year.

A recent American Iron & Steel Institute release points out that bumper

steel (C 1075), containing about 0.8 per cent carbon, long used by automobile manufacturers because of its ability to stand up under heavy punishment before crumpling or breaking, now finds wide use in the manufacture of locking mechanisms of machine guns, where its resilience makes it most valuable.

Production of ferro-chromium for use in steels, containing up to about 3 per cent chromium (not in stainless and heat resistant steels) has been facilitated through an agreement between OPM and ferro-chromium producers, permitting the use of lower grade chrome ores.

Taking over by the Government of

full control over all tin imports, stock and distribution, through the Metals Reserve Co., had been expected for some time. For several weeks before this step was taken, tin importers had been unable to place orders in Singapore at a price that would have permitted their selling the metal at the 52-cent per pound maximum allowed by OPA. All tin now afloat will be shipped on arrival to tin plate manufacturers. Tin for bearings and alloys will have to come from the Metals Reserve Co.

OPM Priorities

(Continued from page 45)

Packard Co. had been turning out 1350 hp. marine engines to power the fast patrol torpedo boats that guard the U. S. Coastline. The GM Diesel Engine divisions at Detroit and Cleveland are making propulsion equipment for submarines and other warcraft, while the Rochester Products Division is turning out fire control apparatus.

Stepping up of the ultimate production peak on four-engine heavy bombers from 500 to 1000 per month, as announced recently by William S. Knudsen, director of OPM, will put pressure on Ford Motor Co., which will be the chief production source for these 28-ton planes. Construction work is being rushed around the clock on the new Ford bomber plant at Willow Run, with production of parts already under way in a completed section of the huge 56-acre plant. By summer the plant is expected to be employing 20,000 men, one-third of the eventual peak. In addition to producing a large number of completed Consolidated B-24 bombers per month, the Willow Run plant also will turn out airframe subassemblies for shipment to Fort Worth, Tex., and Tulsa, Okla., where the planes will be completed in new plants being built by Douglas and Consolidated.

Buick and Chevrolet will further the bomber program by making the 1200-hp. Pratt & Whitney engines, four of which are required to power each B-24. Buick is completing a new airplane engine plant at Melrose Park, Ill., while Chevrolet is altering facilities at its Buffalo and North Tonawanda, N. Y., plants to manufacture these engines. Studebaker also is readying plants at Chicago, South Bend and Fort Wayne, Ind., for making aircraft engines for installation in bombers. Briggs Mfg. Co. and Murray Corp. both are making airframe subassemblies for the Boeing B-17 bomber, another four-engine plane.

So far no automotive companies are making merchant ships, although the Chrysler Corp. has been conducting experiments with the application of 16 110-hp. automobile engines to propel the new Sea Otter type cargo ship. The Sea Otter is a unique craft of 1900 tons of displacement, and is 270 ft. long. It draws less than 10 ft. and is designed to escape torpedoes.

*“Also in the purchase of
new equipment and tools*

MOTOR AGE

has been a big help, as we know practically all of the most reliable manufacturers are represented in Motor Age. We can keep well posted on their products and be in a position to make the best buys in this way.”

The above, of course, is taken from a letter written to us by a MOTOR AGE subscriber. He is typical of thousands of other Motor Age subscribers in that he uses this leading automotive service magazine as a buying guide.

MOTOR AGE

A CHILTON Publication

Chestnut and 56th Sts.



Philadelphia, Pa.